#SmartHealthSystems

International comparison of digital strategies

empirica

Bertelsmann Stiftung

Health System Comparison
Focus Digitalization

#Smart**Health**Systems

International comparison of digital strategies

Part I: International Benchmarking and Digital Health Index

Part II: Success criteria and utilisation rates of digital applications – Comparative country study

Part III: Analysis and Transferability

Authors
Rainer Thiel,
Lucas Deimel,
Daniel Schmidtmann,
Klaus Piesche,
Tobias Hüsing,
Jonas Rennoch,
Veli Stroetmann,
Karl Stroetmann

November 2018

Foreword

The so-called Lipobay scandal can be considered a trigger for a political decision: As early as 2003, the German federal government at the time initiated the development of the electronic health card. The card was intended to help improve healthcare and to make it safer – possible drug interactions were to be identified before they can occur. It was hoped that the German healthcare system would then receive a modern IT infrastructure and become an international pioneer in e-health.

Today, we have to say that this project has not been successful. At least not for the time being. While in other countries, the most important patient data is stored in electronic health records and prescriptions already have been digitally transmitted for several years, Germany is still working on the basics of digital health networks and is mainly exchanging information on paper. While we are talking about the application of intelligent algorithms on a theoretical level in Germany, these have long been in use in Israel for the early detection of cancer, for example.

Not surprisingly, the Digital Health Index developed in the context of this study shows that the German healthcare system is lagging far behind in terms of digitalization: In an international comparison, Germany is ranked 16th out of 17 countries surveyed. For the newly developed index, experts from the analysed countries gave their assessments on more than 150 individual items – on the political-strategic approach, on the technical readiness and on the actual use of the available technological possibilities.

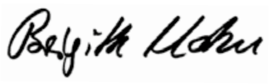
But the findings should not be a reason to bury one's head in the sand – on the contrary. The study report shows that the digital transformation of healthcare systems is hardly a straightforward process in any country, and it is not always a successful story. We can see that countries like the Netherlands or the NHS in England, which have changed strategy after setbacks, are today on a good or at least on a better path.

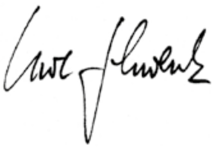
The report contains countless examples of successful and less successful digital health initiatives and approaches. For five of the 17 countries, we have analysed the development lines in more detail. The German health system can and should learn from these examples.

At the political macro level, our analysis shows a clear pattern: digital transformation needs political leadership and coordination. Successful countries are characterised by a trio of effective strategy, political leadership and coordinating national institutions, i.e. "agencies for digital health". The process of digitalization in successful countries is health benefit-oriented and is implemented in pragmatic steps. Politicians in these countries see the promotion of acceptance among patients, doctors and other health professionals as a central strategic task. Moreover: the end users of digital technologies, not (only) their professional representatives, are systematically involved in co-designing strategies and applications.

From the empirical findings, we derive the recommendation that German health policy must continue along the path it has recently taken. Politics must act more decisively than in the past and expand its leading role in the design of digitalization. Finally yet importantly, we need to pick up speed. Not as an end in itself, but for the patients and their physicians, who in Germany still cannot fully benefit from digital health because of missed digital opportunities. There is no need for a new “exogenous shock” like the Lipobay scandal as further justification to advance digital health.

We wish you an interesting read and look forward to exchanging views on the results of the study.





Dr. Brigitte Mohn
Member of the Executive Board, Bertelsmann Stiftung

Uwe Schwenk
Director “Improving Healthcare – Informing Patients,” Bertelsmann Stiftung

Introduction

Digital innovations in healthcare systems can prove crucial to improving healthcare. provision. Digital solutions can improve patient safety and treatment outcomes while facilitating the economic efficiency of a healthcare system and its sustainability. A growing number of international studies as well as post-pilot national and regional assessments show that under the right framework conditions, the digital transformation of a health sector indeed leads to improved service quality and access to services. In addition, international trends show that the networked exchange of data and digitalized healthcare systems are essential to fostering results-driven care because they keep healthcare professionals on top of the latest developments in medical knowledge and thereby improve the quality of care provided.

In international comparison, Germany lags behind in efforts to effectively leverage the benefits of digitalization. Several European and other Western countries are much more advanced in terms of applying and adopting instruments such as an electronic health record, ePrescriptions or electronic communication between patients and physicians. These markers of progress are present not only in the Nordic states but also in several EU states with healthcare systems featuring a much wider and deeper adoption of digitalization than the German healthcare system.

Knowledge about how healthcare systems operate is essential to formulating effective healthcare reforms that focus squarely on patient benefits. At the same time, it is also crucial to understand where, how and why the digital transformation of healthcare is succeeding in order to develop or adapt digitalization strategies that ensure citizens, patients and society as such receive improved healthcare.

Some countries that have proved quite successful with their digitalization strategies can serve as models for Germany. However, in order to derive realistic lessons learned and formulate specific recommendations for action, we must acquire a deeper understanding of each country’s framework conditions, the factors contributing to the success of their strategy and the extent to which digital services are actually used by patients and physicians (digital uptake). Efforts to advance digitalization in Germany can also benefit from the rich variety of digital applications implemented in other countries. Indeed, we see an impressive range and depth of digitalization strategies, rollout measures and actual use of patient data in several countries.

The study presented here is part of an extensive international comparison of healthcare systems with a particular focus on digital transformation. It aims to deliver a cross-national survey and evaluation of the state of digitalization, the reach and depth of use, and success factors of an effective digitalization strategy. In so doing, the report showcases the rich diversity of strategies, their contextual features, and the factors contributing to a health policy that successfully leverages digitalization in order to optimize patient care and health literacy. Two separate studies were conducted for this purpose.

The first, “International Benchmarking and the Digital Health Index,” underpins the first part of this report. For this study, we developed a novel standalone Digital Health Index that evaluates the state of digitalization achieved in a national healthcare system. This index is comprised of 34 indicators relating to strategy, technical readiness, and the digital maturity and extent to which integrated healthcare data exchange is actually taking place. As part of a benchmarking process, data for 17 countries (i.e., 14 EU and three OECD countries) was collected by an international expert network. The results of this process are reflected in several rankings, each of which are an aggregate of scores achieved for a set of indicators.

In addition to independent research conducted for the purpose of the benchmarking process, we designed and carried out a survey to examine and evaluate national digital health strategies in Australia, Austria, Belgium, Canada, Denmark, England (NHS), Estonia, France, Germany, Israel, Italy, the Netherlands, Poland, Portugal, Spain, Sweden and Switzerland. Data was collected on site by a national correspondent located in each country. In addition to the national correspondents’ involvement in the country analyses, the input of additional European and national experts was incorporated into the study for the purposes of validation and quality control. Ensuring the greatest informative value and capacity to derive lessons learned underlie the choices made in the countries to be included in the survey. The study thus includes countries that feature healthcare systems and state structures similar to Germany as well as those countries which, according to our preliminary research, have achieved an advanced state of digitalization.

The second study, “Success Criteria and Level of Uptake of Digital Applications,” which comprises Part II of this report, examines in greater detail five of the 17 surveyed countries: Denmark, France, Israel, the Netherlands and Switzerland. The authors of this study conducted on-site visits to each of these countries in order to acquire a deeper understanding of the success factors and barriers to digitalization efforts. Interviews with representatives of national digital health agencies, ministries, healthcare providers and associations as well as independent experts were carried out in each country. This second study examines in closer detail the political actions and structures in each country as well as their framework conditions. It describes how they work and identifies key factors of success as well as barriers to advancing the digital transformation of a healthcare system.

Part I of this report looks at the issue of healthcare digitalization from a macro-perspective and is informed by quantitative methods. Questions as to “what,” “how much,” or “how often,” inform this section. Part II, however, is driven more by qualitative questions and aims to explain “why” or “how” certain developments have transpired.

Our cross-national analysis of policies and strategies, combined with the precise observations of national efforts to integrate digitalization into the everyday provision of care allowed us to identify criteria of success that can be applied to a transferability analysis of other countries and healthcare systems. Part III of this report addresses the issue of transferability.

Our results are intended to provide inspiration in deepening and accelerating the digital transformation of Germany’s healthcare system. They also identify what Germany can learn from the experiences of other countries. Our findings and conclusions drawn are thus intended to facilitate the formulation of improved digitalization strategies while advancing and accelerating implementation solutions.

Content

NB: The sequence of country chapters is arranged according to country names in German.

Part I:
International Benchmarking and Digital Health Index

1 Introduction

1.1 Background and executive summary

The *International Benchmarking and Digital Health Index* study carries out a cross-national comparison of healthcare digitalization strategies in 14 EU countries and three selected OECD countries. At the heart of this study is the development and compilation of a Digital Health Index that evaluates the state of digitalization within national-level healthcare systems on the basis of 34 indicators relating to strategy, technical implementation status, maturity and the degree to which integrated health-data exchange is actually taking place.

Primary data was collected from 17 countries (i.e., Austria, Belgium, Denmark, Germany, England (NHS), Estonia, France, Italy, Netherlands, Poland, Portugal, Spain, Sweden and Switzerland, along with Australia, Canada and Israel) to create the index. This data was then analyzed and evaluated within the framework of a benchmarking process. To supplement our project team's research and analysis, an on-the-ground expert for each country surveyed collected data specific to each national context and acted as a national correspondent.

Information on digital health systems and the state of digitalization within the health-care sector was collected using a comprehensive set of questions. This survey is divided into three thematic blocks. These, in turn, serve as dimensions for measuring the state of digitalization, and thus define the concept of "digital health." As such, they reflect the cumulative impact of digitalization within a healthcare system, ranging from simple strategies and plans to the actual extent to which digital applications are used, and the scope of data exchange between them. We thus examine activities that range from pure planning to a state of *readiness* for implementation, and then finally to the degree to which digital applications are in fact available.

The three dimensions used to measure the state of digitalization can be described as:

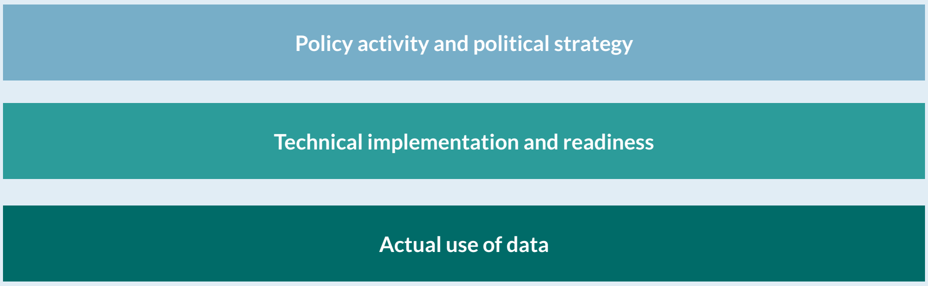
1. the level of politics and policy;[1] strategy; and the financial, legal and regulatory, and institutional framework for digital health systems;
2. the level of maturity and the state of technical implementation, and thus the overall readiness for data integration and use; and
3. the level of actual use of digital health technologies and services, entailing the exchange of data both within and across healthcare sectors (as opposed to non-formalized statements of intent, plans and simple technical preparations).

1 Policy can be defined as the substantive content of political activity. In German, this is often translated as "Politikfeld" (policy field), with research into this area called "Politikfeldanalyse" (policy-field analysis). However, greater analytic precision is offered by the English term "policy," which captures the distinction between the content and thematic processes of politics on the one hand, and the difference between the activities shaping policymaking (politics) and formal-legal aspects (polity) on the other.

As presented graphically below, these three thematic dimensions can be summarized using the following categories:

- Policy activity and political strategy;
- Technical implementation and readiness;
- Actual use of data.

FIGURE 1: **Digitalization-status dimensions**



Source: Bertelsmann Stiftung

The 34 indicators developed for this project reflect these definitions and their associated scope of interest and thematic delimitations, as well as the practical degree of measurability and the study's strategic focus. These indicators are introduced and explained in detail below, in chapter 2.

The three thematic dimensions noted above are captured by an in-depth questionnaire. This approach allows for these dimensions to be compared and visualized as themes across a number of different countries. The Digital Health Index thus considers digitalization from three (interrelated) perspectives, each described and defined one of these dimensions. Each dimension is represented by a sub-index, with the sum of the sub-indices constituting the composite Digital Health Index.

Drawing on the research and findings of existing cross-national studies on digital health systems, we identified specific weaknesses and strengths in such studies. These findings informed how we approach assessing effective digitalization strategies and the actual deployment of digital healthcare solutions at the national level. The following aspects were among those used to guide our cross-national comparison:

1. The selection of national correspondents tasked with collecting survey data was designed to attract national experts from government, agency or industry circles who were independent but also had the necessary specialized policy and technical knowledge.
2. In any cross-national comparison, questionnaires must be formulated in such a way as to avoid all ambiguity, which includes anticipating possible national and regional particularities that could affect how indicators are formulated. Such details should not be relegated to narrative reports stemming from non-quantifiable assessments of interview subjects, which are of limited comparability.

3. We relied on a questionnaire strategy designed to capture a wide range of functionality criteria; the goal was to shed light on the distinctions among existing and already-implemented digital healthcare applications and services, using multi-scale response options to account for the very different systems in the countries surveyed.

We developed an original survey questionnaire in order to avoid weakening the conceptual framework and the phenomena being examined through overlap with existing datasets. This provides added benefit of ensuring that the phenomena could be described with as much fidelity to reality as possible. Thus, where possible, the aim was to be able to justify a reasonable and coherent weighting strategy for the sub-indices, indicators and their various interactions. Individual indicators can be better calibrated, selected and delineated when embedded in such a model.

As part of the data collection and analysis process, additional literature and background research was conducted on the issues of international cross-national comparison and digital health, as well as on methodologies for monitoring and evaluating digital health strategies and implementations. The authors furthermore supplemented the surveys and questionnaires conducted by the national correspondents through the inspection and analysis of primary and secondary sources, including key documents and national-language surveys on strategy, implementation and usage in each of the surveyed countries. Many countries are in a state of non-stop activity with regard to the planning and implementation of digital strategies. With this in mind, this report sets 31 May 2018 as the cut-off date for the consideration of current developments; the single exception is Germany, for which the research deadline is 31 July 2018.

The literature research and document analysis conducted for the survey took place in the period from June 2017 to June 2018. The actual survey was carried out with the help of the national correspondents in the period from December 2017 through May 2018. A process of validation with additional country experts took place during the period from February through June 2018.

1.2 Research question

The goal of the study is to empirically analyze, compare and interpret the cumulative impact of digitalization within selected EU and OECD healthcare systems. We have also drawn conclusions and formulated recommendations that are based on this international comparison of digitalization strategies. The comprehensive country analyses and comparisons compiled in this report allow us to derive, for starters, suggestions and *lessons learned* for the German healthcare system with regard to potentially useful topics of discussion and approaches.

Indeed, a key objective here is to illustrate how Germany might learn from the digital health experiences of other countries. This includes addressing the following questions: Why has digitalization been delayed in Germany? What areas offer the best options for accelerating digitalization?

The study's research question informs the questions that underpin the project:

> What insights can be gained from comparing progress in digitalization within the healthcare systems of different European and OECD countries? How can these insights be turned into actionable policy recommendations for Germany?

One key problem in understanding the extent and impact of digitalization within a given regional or national healthcare system is a lack of comparative analyses examining why digitalization efforts and implementation levels reflect a considerable degree of success in some countries, and not in others. Any analysis of this phenomenon's underlying causes should address the following questions, among others:

- Are the differences due to structural conditions – that is, political actors' and stakeholders' preferences, constellations and power structures – or are they attributable to "soft" cultural factors?
- What role is played by the type of political system? Do federal structures or consensus-driven principles as opposed to majority decisions play a role?
- How is the healthcare system embedded in the economic and political system?

A comparison of national healthcare systems should thus answer, or at least begin to answer, the following questions:

- Is there a strategy for digitizing the healthcare sector? In what other digitalization-strategy frameworks is this potentially embedded?
- What are the most relevant regulatory barriers to this process? How is the healthcare sector organized?
- How are patient and healthcare service-provider data used in the provision of care?
- What standardization plans and programs exist for the cross-sectoral, large-scale exchange of data?

Against the specific background of the German healthcare system, a cross-national comparison should also be able to answer the question of why Germany has lagged behind other nations with regard to digital health systems. What are the sources of this delay, and what areas offer the best options for accelerating digitalization?

The following introductory chapters on the study's theoretical framework and methodological approach will first formulate the exact thrust of our analysis of digitalization strategies and develop a working definition of the "availability of digital applications." This will in turn clarify the perspective from which "digitalization strategies" will be judged. The scope of our intended measurement of each country's state of digitalization is reflected in the three aforementioned survey dimensions. In short, these range from the reach and spread of a country's policy and strategy activities, to the level of technical implementation and actual extent of use (in contrast to "planned" or "promised" implementations), to the degree to which such activities are oriented toward patient benefits (along with the operationalization of such benefits, or their quantification through the use of indicators).

For the purposes of the study's design, we assume it to be true that "digital health" leads to an improvement in "patient benefits," for two reasons:

1. This study builds on a number of other studies that have concluded that the benefits of eHealth solutions or digital health systems are measurably greater than the potential associated costs (even if clear empirical and clinical evidence of improvements in health is often lacking);[2]
2. For pragmatic reasons, the scope of the study does not allow for the collection of data on a scale large enough to be able to generate a direct new proof of benefit in the form of causal and correlative relationships between digitalization and patient-health improvements.

The present comparative country benchmarking process seeks to quantify relative efforts and identify potential steps forward on the path to digitalization. The study's findings are nonetheless constrained by its chosen analytical framework, which encompasses the state and degree of utilization of digital healthcare policies and their manifestations but does not examine their effects on health-system performance indicators. Establishing such a link would require a differently designed and much more comprehensive study. In this regard, existing studies also indicate that the use of information and communications technologies in the healthcare sector seems to be a useful tool for increasing efficiency, expanding access and improving the quality of care, which in sum lead to an improvement in patient benefits.[3]

Existing studies comparing countries and healthcare digitalization

In developing the methodological approach, we closely examined numerous previously conducted and ongoing research projects involving a cross-national comparison of healthcare digitalization. The primary goal here was to identify and avoid potential methodological pitfalls. Particularly notable in this field are surveys and studies by international organizations, such as:

- "From innovation to implementation – eHealth in the WHO European Region":[4] The WHO European Region encompasses 53 countries, including Europe and Central Asia. The study contains no raw data or transparent country-level data; rather, all values are aggregated.
- OECD Survey Model:[5] The goal here is to facilitate internationally uniform monitoring and data collection regarding the state of healthcare-sector digitalization. To this end, Zelmer et al. (2016) developed complex statistical assessment and weighting procedures and tested various benchmarking indicators for assessing the availability and use of healthcare information and communications technology in 38 countries.[6]

2 See, for example, Stroetmann, K., Jones, T., Dobrev A. and Stroetmann V. (2006). *eHealth is Worth it – The economic benefits of implemented eHealth solutions at ten European sites.* [online] Luxembourg: Office for Official Publications of the European Communities, p. 56. Available at: http://www.ehealth-impact.org.; Eysenbach, G. (2001). What is eHealth? *J Med Internet Res,* 3(2).; Bashshur R., Shannon G., Krupinski E. and Grigsby J. (2013). Sustaining and realizing the promise of telemedicine. *Telemed J E Health,* 19(5), pp. 339–345.; Mistry H. (2012). Systematic review of studies of the cost-effectiveness of telemedicine and telecare. Changes in the economic evidence over twenty years. *J Telemed Telecare,* 18(1), pp. 1–6.

3 Bergmo, T.S. (2015). How to Measure Costs and Benefits of eHealth Interventions: An Overview of Methods and Frameworks. *Journal of Medical Internet Research,* 17(11).

4 World Health Organisation, (WHO), (2016). *From Innovation to Implementation – eHealth in the WHO European Regions.* Copenhagen: WHO Publications.

5 Organisation for Economic Co-operation and Development, (OECD), (2015). *Draft OECD Guide to Measuring ICTs in the Health Sector.*

6 Zelmer, J., Ronchi, E., Hyppönnen, H., Lupiañez-Villanueva F., Codagnone, C., Nöhr, C., Fazzalari, A., and Adler-Milstein, J. (2016). International Health IT Benchmarking: learning from cross-country comparisons. *Journal of the American Medical Informatics Association.* [online] Volume 2016, 24,(2), p. 371-379. Available at: https://academic.oup.com/jamia/article/24/2/371/2631498 [Accessed 13 July 2018].

- Studies on behalf of the European Commission: The European Commission commissioned a series of studies that collected relevant comparative information for all EU member countries, as well as some information from other countries, in particular members of the European Economic Area. The research team from empirica (a Berlin-based research institute) played a leading role in a number of these studies. These studies in effect incorporate the recurring surveys and questionnaires carried out in European hospitals and among practicing physicians. This data is also used to develop an index measuring the distribution and availability of eHealth systems in European countries, particularly national-level monitoring of the so-called EU eHealth Action Plan.
  - European Hospital Survey: Benchmarking Deployment of eHealth 2011; Follow-up study 2013
  - Composite Indicators on eHealth Deployment, Use of Functionalities 2011; Follow-up study 2013
  - Benchmarking Deployment of eHealth among General Practitioners 2007; Follow-up study 2013
  - eHealth Strategies: Monitoring national eHealth strategies, DG INFSO, 2011
  - eCareBench: Learning from good eHealth and telecare practices, DG INFSO, 2010-2011
  - Older studies by DG INFSO: EHR Impact: Economic impact of interoperable electronic health records and ePrescription in Europe, 2010; eHealth Benchmarking, 2008-2009; eHealth Indicators Pilot, 2007-2008; eHealth Impact: Study on Economic Impact of eHealth, 2006.
- WHO Health Systems and Policy Monitor: This is an online platform with regularly updated descriptions of healthcare systems in numerous countries. In addition, the Health Systems and Policy Monitor provides information on planned and ongoing reforms as well as changes with policy relevance.
- Commonwealth Fund International Survey of Primary Care Physicians: The U.S.-based Commonwealth Fund is a private foundation in Washington, D.C. It regularly produces comparative international studies on developments in the developed world's leading healthcare systems, especially in North America, Europe and Oceania. In these studies, actors from the national healthcare systems are asked about current themes, using varying methodological approaches and survey structures. However, digital health usually plays only a secondary role.
- Nordic eHealth Research Network (NeRN): This network is a research group reporting to the Nordic Council of Ministers' eHealth group tasked with developing, testing and evaluating a common set of indicators for monitoring eHealth in the Nordic countries. The work of Hypponen et al. (2016)[7] is based on NeRN's findings and indicators and is concerned with the question of the availability and use of ePrescription-related digital health services. It compares the availability and use of these services by patients and medical personnel in the Nordic countries.
- eHealth Trendbarometer HIMSS Analytics: The regularly collected eHealth Trendbarometer questions relevant actors on selected eHealth issues. Most recently, in January 2016, it examined "patient participation" in the German-speaking (D-A-CH, or Germany, Austria, Switzerland) region. These are not representative surveys. However, they provide some insight into certain trends, with the caveat that individuals who are particularly engaged in a given area are also the most likely to participate in such surveys.

7 Hypponen, H., Gilstad, H., Faxvaag, A., and Brattheim, B. (2016). Comparability, Availability and Use of Medication eHealth Services in the Nordic Countries. *International Journal on Advances in Life Sciences*, Volume 2016, 8 (1&2), p. 112-121.

- Academic studies (examples): Smaller indicator-based cross-country comparisons of an academic nature are increasingly being carried out both nationally and internationally. The research focus of such studies varies across individual digital applications and efforts to benchmark the spectrum of digital healthcare.
  - Policy analysis and patient access to electronic patient records: The work of Essén et al. (2017)[8] examines patient access to existing electronic health records (EHRs) in 10 EU and non-EU countries. The focus here is on a policy evaluation of hard (binding) and soft (voluntary) governance mechanisms.
  - Nordic Benchmarking Indices: During its first mandate phase, NeRN developed four comparative indicators for the uniform monitoring of digital health issues in the Nordic countries. In its second phase (2014-2015), the list was expanded to a total of 49 indicators, including EHR components, health-information portals, ePrescription-related services, actual use and data exchange, security aspects, and satisfaction among physicians and patients.[9]

To a certain degree, each of the studies and surveys noted above have their weaknesses, either with respect to their methodological approach, or with regard to their significance or relevance to this study's planned cross-national comparison. In our analysis of these items, we focused primarily on identifying where and how the current #SmartHealthSystems study could go beyond the usual international digitalization studies. It should be emphasized here that biases and subjective considerations can undermine the objectivity and replicability of results, depending on the methods and sources of data collection. For example, many previous cross-national comparisons have been driven by technology or industry entities or have been subject to influence by official agencies for their own purposes. Thus, caution must be exercised in considering many studies that may be subject to methodological biases. The present study borrows a variety of question types and answer scales from the OECD Survey Model, revising and adapting them to the diverse landscape of possible digitalization levels. At the same time, the literature analysis offered a lesson in the value of avoiding the authors' own biases and distortions in answering the question of what constitutes an effective digitalization strategy.

1.3 Outline

Part I of this report is divided into four chapters: chapter 1 – Introduction, chapter 2 – Theoretical framework and methodological approach, chapter 3 – State of digitalization at the country level, and chapter 4 – Digital Health Index benchmarking results, with country rankings.

In the interest of improving rigor and report readability, the analysis and results of the benchmarking process, in the form of useful lessons and a transferability analysis, can be found in Part III – Analysis and transferability. Similarly, the overall methodological approach of Part II can be found in the methodological chapter 2 of this Part I.

8 Essén Essén, A., Scandurra, I., Gerrits, R., Humphrey, G., Johansen, M., Kierkegaard, P., Koskinen, J, Liaw, S., Odeh, S., Ross, P. and Ancker, J. (2018). Patient Access to Electronic Health Records: Differences Across Ten Countries. *Health Policy and Technology,* [online] 7 (1), p. 44-56. Available at: https://www.healthpolicyandtechnology.org/article/S2211-8837(17)30072-2/pdf [Accessed 13 July 2018].

9 Hypponen, H., Kangas, M., Reponen, J., Nöhr, C., Villumsen, S., Koch, S., Hardardottir, G., Gilstad, H., Jerlvall, L., Pehrsson, T., Faxvaag, A., Andreassen, H., Brattheim, B., Vimarlund, V., and Kaipio, J. (2015). Nordic eHealth Benchmarking – Status 2014. 1st ed.[pdf] Copenhagen: Nordic Council of Ministers. Availablle at: https://norden.diva-portal.org/smash/get/diva2:821230/FULLTEXT01.pdf [Accessed 13 July 2018].

Thus, the report is designed as follows: Following the introduction and a short summary of existing studies on cross-national comparisons and digitalization, we provide initial details on the methodological approach. This section focuses on the thematic definition of the survey and benchmarking process, the methodology used for the benchmarking process and the creation of the index, and the description of our actual data-collection procedure.

Chapter 3, dealing with the individual countries, is the heart of the document due to its empirical density and size. The state of digitalization within all 17 surveyed countries is described in summary and analyzed in this chapter. We will also provide an initial classification and a comparison of each country with the state of digitalization in Germany.

Chapter 4 presents the summary results, country rankings and the Digital Health Index. This chapter also includes figures featuring the cross-national benchmarking results.

Chapter sections 7.2 and 7.5 of Part III will address the question of what generalizable conclusions can be drawn from the accumulated country-level data and the results of the Digital Health Index: What are the salient features of the various digitalization strategies and their implementation? What can we learn more broadly from the individual countries, and what elements of these distilled lessons might gain attention in Germany with the help of an initial transferability analysis?

We will also return to these initial transferability analyses in Part III, developing them further for the five countries subject to more in-depth study.

2 Theoretical framework and methodological approach

Due to their different subjects of focus, modes of implementation and approaches, as well as their independent analytical concepts, the two studies underlying this project also have different study designs, and correspondingly different theoretical and methodological frameworks. This report, however, presents the theoretical and methodological explanations for both within a single chapter. Thus, the following chapter 2 is divided, with chapter 2.1 addressing the methodological approach used in Part I, and chapter 2.2 focusing on Part II.

2.1 Study part I: International benchmarking

2.1.1 The thematic dimension of the survey and the benchmarking process

The thematic and substantive dimensions of the questionnaire-based survey, carried out in this case by national correspondents, inform the structure of the data collection as well as the orientation of the study itself. Thus, while the thematic blocks are each important in a content-related context, they also follow an internal structural logic. Each block can be individually measured and thus portrayed in its own index. Each can also be set into relation with the others, with the sum total being regarded as the composite index, and as a measurement of digitalization in the healthcare sector.

The substantive and dimensional demarcations within the survey data to be collected – this constituting the essence of the study's design innovation and validity – arise from the project team's comprehensive and detailed development of the many individual questions provided to the national correspondents. These define the overall scope of the questionnaire. On the basis of the above-described literature research and the analysis of so-called gray literature (such as unpublished reports and policy documents) on digital health issues, the team identified the thematic characteristics underlying each of the three dimensions. This allowed the structure to be refined.

As a first interim step, the area of policy activity and strategy was divided into two. On the one hand, this dimension encompasses pure strategy development and political or legislative initiatives; on the other, it includes the increased requirements associated with implementation of such strategies, for example through the establishment of relevant institutions (e.g., a digital health authority), the provision of budgetary resources, and/or the passage of concrete legislation or regulations. Similarly, the dimension addressing readiness for networking and data use can be subdivided into several categories, including the implementation of infrastructure and administrative resources; the maturity of digital

TABLE 1: **Thematic overview of benchmarking indicators**

P	**Policy activity and strategy**
	Digital health strategies
P1	Digital health and general healthcare strategy / healthcare policy
P2	Political support for the transfer and exchange of data
P3	Strategies for digitizing the healthcare system
P4	Guidelines for planning and implementing digital health applications
P5	Stakeholder engagement in the planning and implementation of digital health programs
	Digital health policy's institutional backing, financing, and legal framework conditions
P6	National and regional financing for the implementation and operation of digital health applications and services
P7	Legal oversight of national digital health program implementation
P8	Public and private financing for digital healthcare services
P9	Financial incentives for service providers
P10	Legal framework for the exchange of patient data
P11	Legislative frameworks for secondary use of data
P12	Human-resources development and digital health competences
T	**Technical implementation and readiness for data integration and use**
	Implementation: Infrastructure and administration
T1	Regulation of access rules to electronic health records (EHRs)
T2	Security measures for the protection of privacy
T3	Institutionalization of standardization activities and health informatics
T4	EHRs and patient summaries
	Maturity of digital health applications and services
T5	ePrescription services
T6	Telehealth and telemedicine
T7	Health information portals, patient empowerment mechanisms and patient-centered care
T8	Patient ability to access and review EHRs
T9	mHealth and mobile apps as a part of routine care
	Readiness for data use and exchange: Technical and semantic interoperability
T10	Universally managed clinical terminology and technical interoperability standards
T11	Availability and use of standardized terminologies
T12	Linking of national health datasets* or EHRs to facilitate evaluation, health monitoring and process improvement
T13	Cross-border data transfer possible
A	**Actual use of data**
A1	Physician access to and use of patient data
A2	ePrescription penetration rate
A3	Level of use of electronic health records
A4	Exchange of data between healthcare professionals
A5	Exchange of data with third parties (e. g., analysts or researchers)
A6	Use of patient data for monitoring purposes within the healthcare system
A7	Automatic retrieval of patient data from EHR systems
A8	Patient data includes structured and coded content
A9	Use of health information portals

* National collection of personal health data for the purposes of improving the population's health and productivity, monitoring security issues, and ensuring patient-centered care within the healthcare system. Examples could include quality- or disease-specific registries or simply EHR-system extracts.

Source: Bertelsmann Stiftung

health applications and services; and the country's *readiness* to use and exchange data in the sense of technical and semantic interoperability.

Overall, the aspects of policy activity and strategy encompass the extent to which actual strategies and policies are formulated, but also the regulation and provision of financing mechanisms, legal oversight of the strategies' implementation, and more general laws.

Technical implementation includes aspects such as access and authentication mechanisms; the creation of an implementation framework; the question of what digital services will be offered; and finally, the issue of whether different healthcare-sector data systems will be able to communicate and exchange data with one another using appropriate interoperability frameworks. Lastly, the dimension dealing with the actual use of data encompasses care providers' and patients' access to digital services, the penetration rate of these services, and the scope of data exchange between healthcare professionals working in standard care settings.

Indicator development

In the social sciences, indicators are generally considered to be measurement units or quantities used to operationalize theoretical concepts, or, as in the current case, to operationalize the thematic dimensions of this study's survey. The indicators contained in table 1 were developed with reference to a) the project team's initial substantive and thematic demarcation and definition of the three thematic blocks or dimensions of digitalization; b) the subsequent refinement of the study's overall analytical focus; and c) considerations of methodological and operational practicality. These indicators constitute the foundation of the study's measurement of digitalization in national healthcare systems, while also underlying the associated benchmarking process. Each individual indicator was operationalized – that is, rendered capable of response, and thus made measurable and internationally comparable – using four to six questions.

2.1.2 Approach and methodology: Digital Health Index

Benchmarking

The concept of "benchmarking" was originally developed as a means of comparing products and manufacturing methods. In its original sense, a benchmark is a measure obtained through a pattern or standard, against which an item can be compared, for example. In comparative political science, benchmarking is generally understood as a multidimensional comparison of existing practices that allows for the identification of differences and examples of so-called best practices. Ideally, reform efforts should then be guided by the best practices highlighted by the benchmarking process, with the goal of achieving similarly good outcomes. Of course, this simplified perspective does not initially account for systemic conditions or path dependencies.

Typically, a set of measuring instruments is designed for the benchmarking process. This process entails the compilation of system indicators, and the measurement of factors such as preliminary conditions, costs, outcomes and impact.

In many cases, rather than relying on an objective standard, the benchmark is based on the "best" measured value in the sample. If independence from other dimensions of measurement is assumed, these "best" values in the various dimensions can thus also come from different objects of study (in this case: countries). The benchmark would then represent a profile of the best values measured in the sample.

However, if one by contrast assumes that there may be incompatibilities or trade-offs between the dimensions of investigation, it will naturally be impossible to optimize all dimensions simultaneously. In this case, the performance of one dimension is purchased with "poorer" performance in another dimension. Rather than being ordinally comparable, two different profiles would then probably be only the expression of an optimization on the basis of different preference orders.

It is therefore always important to be mindful of these simplifying assumptions (no incompatibilities, no consideration of preliminary conditions in the form of systemic differences) when examining the index values. In this sense, a benchmark is to be understood simply as the "best possible observed practices," and not necessarily as a target value to strive for within an existing national context.

The benchmarking process used in this study is carried out largely through the development and use of indices or so-called composite indicators, which are described more precisely in the following chapter. The Digital Health Index and its sub-indices order and encapsulate the collected data on the state of digitalization and its associated policy activities on the basis of one or a few thematically delineated measures, thus rendering the complex individual findings of the present comparative research project more accessible and easier to communicate.

In this regard, indices are in no way intended to replace comparative analyses of success factors or national characteristics; rather, they should facilitate the ability to think further and generate new hypotheses. As with every reduction in complexity, an index construction that produces broader-brushed orientation heuristics results in some information loss. For this reason, even if an index-based approach enables systems to be ranked, as will take place in the following sections, it can never replace the analysis of individual cases and context-dependent causal relationships.

Composite indicators

Composite indicators, or indices, use mathematical operations to combine individual indicator values into an index value. Composite indicators are primarily used to capture multidimensional concepts such as education, welfare, digital business activities and so on, reducing their complexity in order to facilitate comparability. There are diverging views with regard to the added value of composite indicators, particularly if they are heavily summarized.

However, it is important to note that the use of indices has increased in recent decades, and a consensus has emerged regarding standards of good practice in index creation. Pioneering work has been done particularly by the United Nations, for example in the case of the Human Development Index,[10] as well as by the OECD and the European Commission's Joint Research Center.[11] There are currently numerous examples that confirm the usefulness of indices, particularly in the political sphere, which by its very nature cannot be measured

10 Anand, S. and Sen, A. (1994). *Human Development Index: Methodology and Measurement.* New York: UNDP.

11 Organisation for Economic Co-operation and Development, (OECD) and Joint Research Centre, (JRC), (2008). *Handbook on Constructing Composite Indicators: Methodology and Users' Guide.* [pdf] Paris: OECD Publications. Available at: http://www.oecd.org/sdd/42495745.pdf.

TABLE 2: **Composite indicators – Opportunities and risks**

Opportunities presented by composite indicators*	Risks presented by composite indicators
Composite indicators (CIs) capture complex, multidimensional subjects by reducing their complexity: They depict the "big picture"	Misleading, insufficiently complex or invalid messages: CIs can lead political decision-makers to make "pseudo-informed" decisions
CIs are a powerful visualization tool	Overaggregation: The meaningfulness of CIs declines when aggregated indicators are too heterogeneous
CIs are an instrument for initiating a public debate ("Why are the figures the way they are?")	"Populism": CIs create simplified discussions (and possibly political decisions)
CIs enable or facilitate benchmarking	Downstream costs: CIs increase the amount of data required
Proponents' underlying assumptions	**Opponents' underlying assumptions**
It is possible to calculate a useful "bottom line" from various component data	The statistical representation of reality should end at the point where a suitable set of (individual) indicators has been created
CIs are a well-proven method, and are essential in data-intensive sectors, particularly with regard to financial services (e. g., stock indices)	Arbitrariness in the weighting of component indicators; "weighting" is however unavoidable; even the use of equal weights for each component indicator is a form of weighting

* Adapted from Saisana, M., and Tarantola, S. (2002). *Composite indicators: the art of mixing apples and oranges.* Ispra: Joint Research Center of the European Commission. As well as the Organisation for Economic Cooperation and Development, (OECD) and Joint Research Centre, (JRC), (2008).
Source: Bertelsmann Stiftung

with one or two simple indicators. Indices can thus be used as instruments for initiating public debate on particular political objectives, at least if the underlying phenomena can be uniformly measured.

Despite the controversies relating to the use of indices for political analysis, and despite their limitations, they are a much-used tool in complex international benchmarking processes such as the various rankings produced by the World Economic Forum, including the Global Competitiveness Index, the Networked Readiness Index and the Inclusive Development Index.

The 10-step guide to the construction of composite indices contained in the OECD / JRC Handbook[12] offers a robust framework for working on and with indices. These steps, as applied in this project's methodology, are described in detail below.

Structure and formation of the Digital Health Index

Digital health and the state of digitalization within a healthcare system are captured by the survey questions and divided into the three thematic dimensions presented in chapter 1. These three dimensions are covered in detail in the questionnaires provided to the national correspondents. The three thematic blocks of the questionnaire-based survey process can be summarized as follows:

Figure 2 shows initial example indicators for the individual dimensions. At the same time, it is clear from the arrows how the dimensions mutually influence one another. However, each of the three Digital Health Index dimensions can also be understood as an independent composite index.

12 See footnote 11.

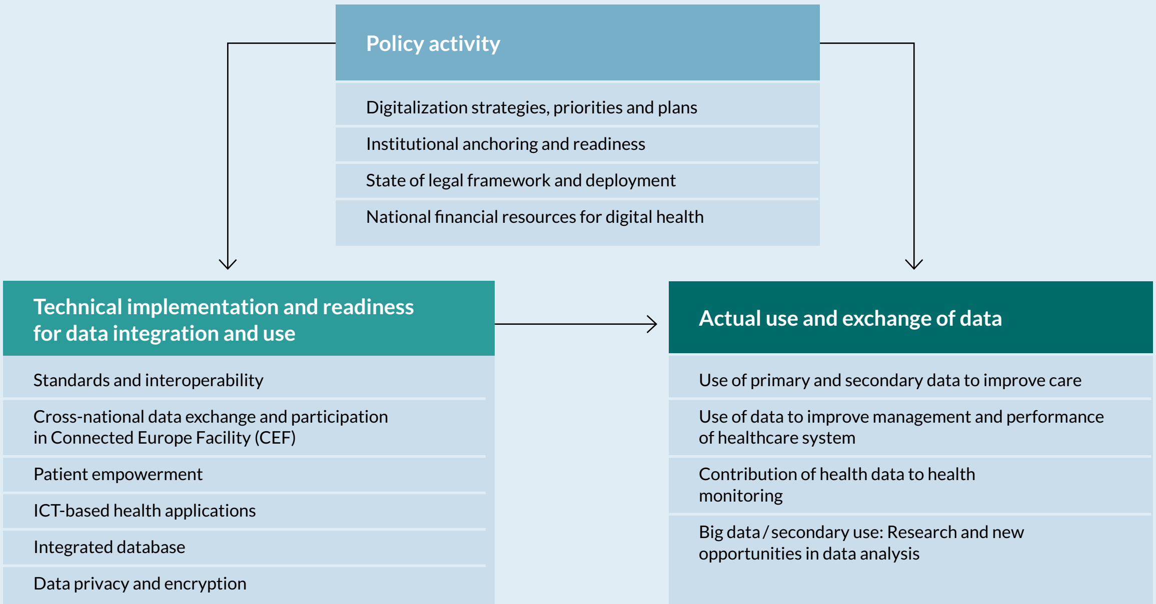
TABLE 3: **Guide to the construction of composite indices**

Step	Approach taken
Development of a theoretical framework	See chapter 2.1.1
Selection of variables	Because primary data was collected, the selection of variables was necessarily guided by their ability to be collected within the context of the study, rather than by availability per se. The variables were then derived from the conceptual framework, with the three subcategories operationalized as exhaustively as possible.
Imputation of missing data	No imputation of missing data took place. In the case of indicators measuring the presence or absence of a particular feature, actual absence is assumed only in cases in which the absence of the feature is presumed, but the correspondents did not want to confirm this definitively for us (in short: without evidence, an indicator takes the value of 0).
Multivariate analysis	Due to the low number of cases (n =16), a multivariate analysis, for example for the purposes of studying dimensions (factor analysis) or for the exclusion of highly correlated indicators, was omitted.
Normalization of the data	All indicators are normalized within the value space of [0;1]. The value 1 is always the “positive” value, reflecting a higher level of digital health development.
Weighting and aggregation	No weighting of individual indicators was carried out. An implicit weighting derives from the decision to give each Sub-index the same weight. This inevitably produces an implicit weighting in the sense that the indicators in sub-indices composed of numerous indicators are underweighted, while the indicators in more sparsely populated sub-indices are more highly weighted. However, the effect can be justified* on the content level, as each constitutive construct within a Sub-index is intended to have equal weight.
Robustness and sensitivity	Due to the large number of indicators, no individual indicator value has significant influence on the results of the composite index. The weighting was consciously chosen to be simple, so the influence of each of the three sub-indices is about the same.
Back to the details	The recommendation to regard the index results as occasion for a deeper analysis of their constituent details is emphatically shared. An analysis of the correlations between the sub-indices follows.
Links to other variables	A consideration of systemic variables, as well as variables of economic maturity, is carried out.
Presentation and dissemination	The primary goal of the study, alongside pure interest in the knowledge itself, is to develop and recommend policy options. These working steps are subordinated to the creation and analysis of the index; however, this constellation of objectives was taken into account in the construction of the index.

* Often, a lack of weighting is mistakenly considered a neutral choice – however, this is not true, and can lead to bias. Equal weights also mean that each basic indicator is worth the same amount. If this is applied to two basic indicators with a high degree of correlation, this approach is tantamount to doubling the score. Even if the basic indicators are grouped into subgroups, with the CIs constructed out of these latter formations, this results in asymmetrical structures. Because the subgroups contain more basic indicators, they have correspondingly more weight. However, this cannot be justified without a theoretical basis, and emerges solely from a technical decision that has not been well thought through. The equal weighting of arbitrarily selected basic indicators further entrenches this problem. The handbook cited in Footnote 12 considers the use of principal component analysis and factor analysis as suitable methods for examining weightings (assuming that basic indicators are correlated).

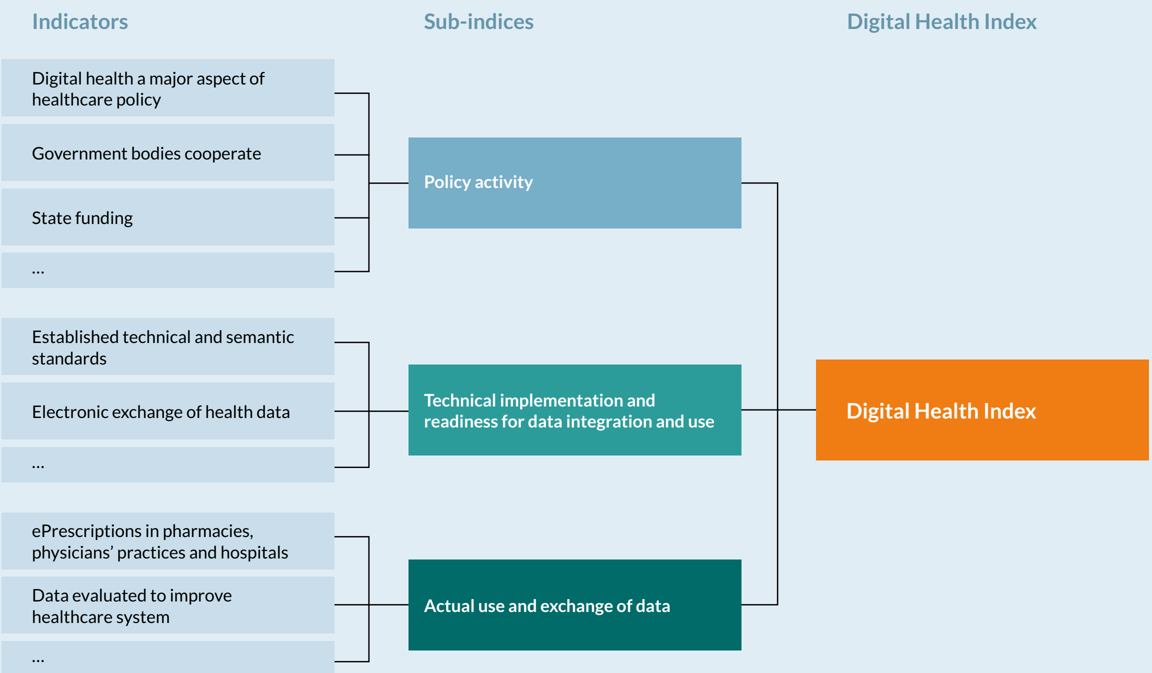
Source: Bertelsmann Stiftung

FIGURE 2: **Overview of the Digital Health Index**



Source: Bertelsmann Stiftung

FIGURE 3: **Overall framework for the construction of the CIs for the Digital Health Index and its sub-indices**



Source: Bertelsmann Stiftung

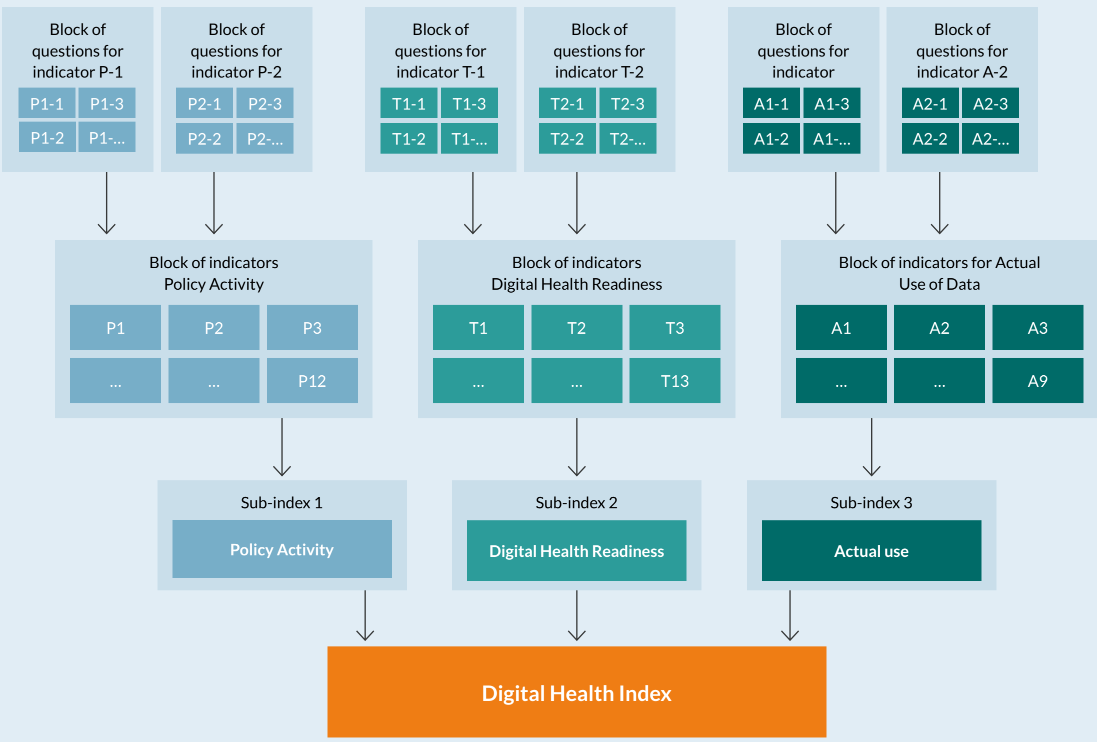
As shown in figure 3, the overall framework of the Digital Health Index is constructed as a composite indicator from three equally weighted sub-indices, which are composite indicators in their turn. The indicators are presented in the following overview. Each of the indicators in turn consists of one or more survey questions. Each of the survey questions was normalized for the purposes of the evaluation using a range of values from 0 to 1, usually such that a complete, nationwide presence is assigned a 1, non-presence a 0, and gradations for qualities and observations that cannot be clearly assigned given a range of intermediate values from 0 to 1.

The points for each answer in the question block are added together and divided by the number of questions in the block. Finally, the value is multiplied by 100. This gives the percent value for each individual indicator.

Where multiple questions are combined within a single indicator, appropriate aggregation rules have been applied. An indicator typically consists of four to six questions. The point values within each block of indicators are added and divided by the number of indicators in that block. This produces the point value for each sub-index. Comparable types of components are weighted equally within the sub-indices, as are the sub-indices themselves. Thus, each indicator within a given sub-index has the same weight. The mean value of the three sub-indices produces the Digital Health Index score.

Figure 4, “From the question to the index,” illustrates the process and structure of the index and its sub-indices.

FIGURE 4: **From the individual question to the Index**



Source: Bertelsmann Stiftung

Digital Health Index presentation formats in the country reports

The actual results of the benchmarking process, in the form of the Digital Health Index and the country rankings based on it, are presented using table-based and cartographic illustrations in chapter 4. In addition, additional derivatives have been prepared in other graphical presentation formats for the individual country reports. The methodological approaches used to produce these separate maps and profiles are briefly outlined and explained below.

Digital health maps

The points achieved by the 17 countries in the Digital Health Index and its three sub-indices are divided into four groups that are as uniform as possible. The groups combine countries with similar Digital Health Index score totals. The borders of the group intervals are not defined on an a priori basis. Rather, they emerge from the observations and the data. To the extent possible, interval borders are meant to reflect large "jumps" in the rankings. As an example, say that five fictional countries have respectively attained 44, 45, 48, 62 and 64 points on the Digital Health Index. Country three and four, with a 14-point difference, sit far apart from one another, a fact that allows a pattern to be identified. This suggests the division into two groups: countries 1-3 and countries 4-5. As a key rule of thumb, the distance between the points of a given group's countries must be smaller than the distance between the groups.

The data was visualized spatially with the help of a geographic information system (GIS) and free geodata from Geofabrik, and colored. The scales and the corresponding colors can be seen in the legends for the maps in chapters 4.1 and 4.2.

Country-based digitalization profiles and index comparisons

Each country report is accompanied by an individual digitalization profile. Here, the Digital Health Index indicators are listed in table form as a digitalization profile, in the same order as in the questionnaire. These profiles also indicate how the thematic blocks and sub-indices are divided. In addition to the indicators presented in table 1, these country-chapter tables also present the number of points awarded for each of the indicators. Between one and five points are awarded for each indicator, based on the percent of total points attained. Five points is the equivalent of 100 percent of the possible points within the indicator. One point is given if fewer than 25 percent of the points have been achieved. A country receives four points if it has attained between 75 percent and 99 percent of the maximum possible points. Three points are awarded for attaining between 50 percent and 74 percent of the possible points, and two points for 25 percent to 49 percent. This assessment is based on the statements used to evaluate the indicators (see figure 4), which are then scored with 1-5 points. Here, one point means the statement does not apply, while five points means it applies completely.

As an index comparison, each country chapter additionally contains a bar chart contrasting Germany with the specific country's Digital Health Index results, as well as with the sub-indices for policy activity, digital heath readiness, and actual data use. In this depiction, the points achieved are represented on a scale ranging from 0 percent to 100 percent, and reflect only the relative values, not the absolute number of points achieved.

2.1.3 Data collection, survey und questionnaire management

Country selection

For the present comparison, 14 EU countries and three additional OECD countries were selected. The country selection was made by drawing on indicators. This means that in order to facilitate comparison both to each other and to Germany, the countries had to exhibit certain structural characteristics, while also allowing for a high degree of general significance and exhibiting a broad range of different structural and political characteristics. The indicators used to distinguish the countries to be examined included the following:

1. The mix of countries should include nations with a relatively high degree of political relevance within the EU. This was measured on the basis of economic strength and the size of population. On the one hand, the large countries often wield particular international influence in a number of policy fields; on the other, their size and economic strength enables a direct comparison with German as the economically strongest member of the EU.
2. For the purposes of the social-science and political-science comparisons to Germany, countries should be chosen so as to enable a fruitful comparison of political systems in general and of healthcare systems in particular, in the sense of a *most similar systems design.* Factors to consider here included, for example,
   a) the presence of a strongly federalist political system,
   b) the character of the local healthcare financing system (for example, the British Beveridge system versus the Bismarckian social-insurance principle versus mixed financing systems), and
   c) the principle of self-government or corporatism in the German or Dutch style.
3. Fruitful lessons are of course to be anticipated particularly from countries where we expect to see digitalization broadly adopted. These countries should therefore

FIGURE 5: **Overview of country selection**

Source: Bertelsmann Stiftung

be considered independently of the first pair of selection indicators. These expectations of high levels of digitalization adoption were derived from other studies' findings and research previously conducted by the study's authors.

Finally, the selection of countries was of course subject to cost-efficiency criteria related to this study's available resources. This represents an implicit fourth indicator, so to speak. As a result of this weighing of indicators, the following national healthcare systems were selected as objects of study:

Managing correspondents and the questionnaire

Drafting the questionnaire and indicator-based questionnaire development

The questionnaire was developed over a period of eight months and validated in a pre-test process with two international digital health experts with considerable survey experience. The indicators' underlying content is based in part on studies in which empirica previously participated as an author team on behalf of the European Commission, WHO and the OECD, among others, as well as on larger additional international studies by WHO and OCED and other regional studies (see chapter 1.2). The sub-indicators and individual indicators were initially thematically defined in an iterative process, and then gradually filled out with concrete formulations. Using the subject-area literature and research into related gray literature as a basis, and with due consideration of the study's substantive focus, the 34 indicators introduced above were each assigned four to six questions, the answer to which was intended to provide a meaningful – that is, simultaneously transnational and significant – assessment of the indicator.

The development and definition of the indicators was guided on the one hand by what was necessary and desirable – that is, the indicators one would ideally need to compare health-care systems with a focus on digitalization – but also by what was deemed feasible – that is, what could actually be measured in the countries being surveyed, or what could actually be answered. One challenge in developing such a comprehensive questionnaire for an international, 17-country benchmark survey was the need to keep all questions at a general, comparable level, while at the same time covering the diversity of (possible) national and regional activities and particularities.

Thus, on the basis of the previously developed indicators, we composed an overall catalogue of questions to serve as the basis for the national correspondents' surveys, as well as for the research by additional experts and as a guide for our own research. This questionnaire contains 154 individual questions.

As an example, the following enumeration includes the individual questions for the "P7: A national digital health entity has been established for legal oversight of digital health implementation efforts" indicator:

P7: A national digital health entity has been established for oversight of digital health implementation

- Is there a national digital health authority (administrative organ, institute, agency)?
- If so, does this authority have oversight power over the digital health strategy, related investments, or the implementation of national components of the digital health program?

- If yes, is it responsible for organizational tasks such as the communication and dissemination of information on digital health issues (or on the implementation of digital health programs).
- If yes, can the authority provide official comment on pending legislation, or can it be consulted as legislation is drafted?
- If yes, does the authority carry out evaluations or assessments of digital health applications?
- Is there an authority that holds long-term responsibility for assessing the health (as opposed to the economic) impact of digital health activities?

The process of obtaining answers to this questionnaire, along with the need for additional further research, required the use of local and national on-the-ground experts in each of the countries being surveyed, and was conducted as a multi-stage procedure. As noted in the introductory chapter, these national-level experts are called “national correspondents” in this report due to their special position and availability in each country.

Using a consistent process based on standardized, internet-based data-collection techniques and instruments, comparable information was collected from the correspondents in each of the countries. This information was then aggregated in a clearly structured and comprehensive compilation of digitalization strategies and implementation activities within all surveyed countries.

This process resulted in the successful collection and analysis of country-level information, which, in conjunction with the study authors’ own research, enabled the compilation of general information about each country and its healthcare system, current conditions, and relevant background information, as well as the accumulation of additional information and assessments of individual national digitalization strategies (policies, roadmaps, laws, etc.). Final crucial elements of the survey include the wide-ranging and in-depth overview of national implementation progress, as well as a presentation of the extent to which digital health systems are actually used at the national level.

The questionnaire for Germany was answered using the following, separate method: First, the questionnaire was answered by two senior experts in an initial blind process. In a second step, differing answers were aligned in a workshop and through additional research. In a third step, the answers were reviewed and validated by an external expert from one of the self-governing bodies from within the German healthcare system.

Questionnaire management

In the interests of better comparative analysis of the data and robust benchmarking, the quantity of open-ended text questions was kept to a minimum, although this opportunity was provided within each of the thematic blocks. An upload button for each block also enabled the correspondents to pass on supporting or supplementary documents, reports or papers. These documents, many of which were in their original language, were used as an additionally valuable source of literature for the project team’s own internal validation of the information, as well as for the production of the individual country reports (with differences here based on the language in question).

The scale system used for most of the survey questions allows for only a simple binary response:

[ ] Yes
[ ] No

This ensured that answers would be comparable and aggregable for the purposes of the sub-index benchmarking and the production of the overall Digital Health Index.

In this case, only “yes” responses contributed simple points toward fulfillment of the composite indicators. The higher the number of points in an indicator’s battery of questions, the higher the number of points used to determine how fully the statement associated with that indicator applied. Assessing and measuring the state of digitalization and technical implementation within individual countries requires the use of a graduated model of digital health development. Based on lessons from the policy analysis and other existing surveys, we determined that such a model must take two dimensions into account:

1. the spectrum of planning regarding genuinely nationwide implementation of a technology; and
2. the regional variance or sub-national characteristics of healthcare systems possessing a strongly regional or decentralized nature (e.g., Spain or Sweden).

The following response scale was thus provided for the majority of the “Technical Implementation” thematic block:

[ ] No
[ ] In the planning stages
[ ] Informal – individual activities at the local level with little or no regional/national coordination
[ ] Pilot projects for regional rollout
[ ] Pilot projects for national rollout
[ ] Routinely used at the regional level
[ ] Routinely used at the national level

While the “Technical Implementation” section encompasses activities related to the development, introduction or operation of digital healthcare applications – thus, the potential held by various applications – the third “Actual Use of Data” section covers the share of data actually exchanged electronically between care providers, using a four-level percent-based answer scale (in the case of missing data, respondents were requested to use their existing knowledge and expertise to assess the most probable value):

[ ] Less than 25 percent
[ ] More than 25 percent; less than 50 percent
[ ] More than 50 percent; less than 75 percent
[ ] More than 75 percent

Selection of national correspondents

The choice of country experts as national correspondents for this study took into account each individual's depth of practical and theoretical knowledge regarding national digital health policies, as well as his or her institutional background. Here, particular value was placed on independence from industry, public-agency and especially political interests. As a result, digital health experts with a university background or previous work experience in national digital health or healthcare institutions make up the bulk of the correspondent group. Experience in the subject area, and thus a corresponding familiarity with public discussions and the implementation of digital healthcare policies in the country being examined, was a further criterion in this choice.

A detailed listing of the national correspondents for each country provided below. For reasons of personal privacy, but also for the methodological consideration of enabling a more open exchange of information, individual names are not given.

In addition to the national correspondents' involvement in the country analyses, additional European and national experts were incorporated into the study for the purposes of validation and quality control.

TABLE 4: **List of national correspondents**

	Professional background
Australia	Professor of clinical informatics, former adviser to the British and Australian governments on digital healthcare infrastructure programs
Belgium	Professor of medicine and health sciences, former vice-president of the European Institute for Health Records
Denmark	Professor of medical informatics and Danish Center for Health Informatics
Germany	empirica experts and external experts
Estonia	Former executive, Estonian eHealth Foundation
France	Executive at French national healthcare authority
Israel	Health policy consultant, former director of the Maccabi Institute for Health Services Research
Italy	Consultant, chairman of HL7 Italy
Canada	Digital health consultant; former vice-president for clinical adoption and innovation at Canada Health Infoway
Netherlands	Medical sociologist; founder and chair of the Netherlands Standardization Institute for Information Technology in Healthcare
Austria	Professor for eHealth research
Poland	Journalist covering digital health issues, publisher of a Polish healthcare magazine
Portugal	Public-health consultant, former strategic advisor for the Portuguese Ministry of Health and the EU Commission
Sweden	Professor for medical informatics and coordinator for Sweden's national eHealth research network
Switzerland	Professor for medical informatics, former member eHealth Suisse
Spain	University research director for healthcare technology and eHealth
United Kingdom (NHS England)	Director of eHealth research for the European Health Telematics Association

Source: Bertelsmann Stiftung

Comparability of nationally and regionally constituted healthcare system types

The survey that forms the basis for this study, and thus for the assessment and production of the Digital Health Index, is based on a country-specific survey process. This means that the indicators and questions focus on the specific national healthcare system as a subject of examination. However, among the countries surveyed for this study are also political systems in which healthcare systems are not nationally constituted, either with regard to the provision of care or its legal regulation. Rather, these systems are organized with a strongly regional, local or sub-national character. Such countries include the federal systems of Canada and Switzerland, but also Italy, Sweden and Spain (and to a lesser extent Denmark as well).

Two methodological approaches were combined in order to ensure comparability between these systems and those organized at the national level, as well as to preserve the viability of the benchmarking process:

1. To capture the state of technical implementation, answer scales were defined that differentiated between the state of implementation at the regional level and that at the national level.
2. Moreover, in order to accord with the objective of the study – that is, to be able to identify digitalization successes in various healthcare systems, and to be able to learn from this information – regional healthcare systems were also defined as full health-care systems, comparable with those at the national level. From a practical standpoint, the correspondents in Spain, Sweden, Canada and Italy were instructed that if at least three regions or provinces could answer "yes" to one of the survey's questions, then this should be treated as equivalent to and synonymous with (and thus used as the value for) the national level.

2.1.4 Summary of methods and scope

For the theoretical framework and methodological approach used in Part I, the particular features of the *International Benchmarking and Digital Health Index* study with regard to scope, methods and focus can be summarized as the following:

- A comprehensive questionnaire with 154 detailed questions was developed and prepared, and then filled out by 17 independent national correspondents and experts from the individual countries being examined.
- The survey and data-collection process was packaged into 34 measured indicators, which in turn are presented in a main index and four sub-indices. This serves to depict the full spectrum of digitalization affecting the healthcare sector and the provision of healthcare or related services at the national level.
- The data collection fundamentally focused on what has in fact been implemented and is a part of standard care in the 17 countries examined, rather than what is politically or technically planned, or what has been announced and promised in documents and pres-entations.
- The study has a qualitative and quantitative policy focus, driven by social-scientific and political-scientific approaches and methodologies rather than using information technology or purely statistical approaches.

2.2 Part II: In-depth country comparison

2.2.1 Country comparison, implementation studies and digital health

In the theoretical-academic discourse, the medical-sociology and public-health research fields have addressed the introduction of technological innovations in the healthcare sector and the variables influencing the scope, speed and success of adoption and implementation processes. However, most arguments stem either from "economic cost-efficiency considerations," "sociological technology studies," or from controversies over the "social desirability of technological innovations."[13]

In contrast, institutional, regulatory and political variables play only a minor role in studies of diffusion or implementation. For example, some studies examine the impact of political and economic variables on the implementation of telemedicine programs in the United States. Their results indicate that interest-group strength, party politics and legislative professionalism all have a significant influence over the extent of implemented telemedicine programs.[14]

This topic has also been the subject of research in Europe. In 2016, for example, the WHO examined the development of eHealth programs in European and Central Asian countries, making the four following recommendations to national governments:[15]

1. Explicit political commitment by governments in the European Region to adopting eHealth is required. This commitment needs to be backed by sustainable funding for the implementation of eHealth programs and actions for capacity-building and evaluation that are aligned with a national strategy for eHealth.
2. An inclusive and intersectoral approach to the development of national eHealth strategies is recommended – to ensure their relevance to all stakeholders and to promote shared action in achieving health objectives.
3. Detailed legislation surrounding the use of national electronic health records should be further developed and harmonized by Member States. Such legislation should ensure that patient rights in relation to access and management of data are appropriately addressed.
4. A systematic approach to the adoption of eHealth standards for data exchange and interoperability needs to be taken, with a national body in each member state clearly identified to govern this process.

German political scientists too, using a purely statistical model, have examined differences in the use of eHealth tools across 24 EU member states, coming to the conclusion that "the speed of implementation depends above all on political factors. We note that economic and particularly health-related variables account for none of the cross-national variance … Governments that have integrated eHealth applications quite early into political documents have adopted more telematics applications."[16] However, the quantitative approach of this study ultimately prevents a determination of a)whether it is in fact reporting apparent cor-

13 Lang, A. & Mertes, A. (2011): E-Health Policy and Deployment Activities in Europe. *Telemedicine and e-Health.* 17 (4), pp. 262–268, DOI: 10.1089/tmj.2010.0174.

14 Schmeida, M. McNeal, R. and Mossberger K. (2007). Policy Determinants Affect Telehealth Implementation. *Telemedicine and e-Health.* 13 (2), p. 100–107.

15 World Health Organisation, (WHO), (2016). *From Innovation to Implementation – eHealth in the WHO European Regions.* Copenhagen: WHO Publications.

16 Lang, A. & Mertes, A. (2011): E-Health Policy and Deployment Activities in Europe. *Telemedicine and e-Health.* 17 (4), pp. 262–268, DOI: 10.1089/tmj.2010.0174.

relations with weak or no causal relationship, as well as b)why eHealth-related documents lead to more telematics (as in the example given above), and what measures are responsible.

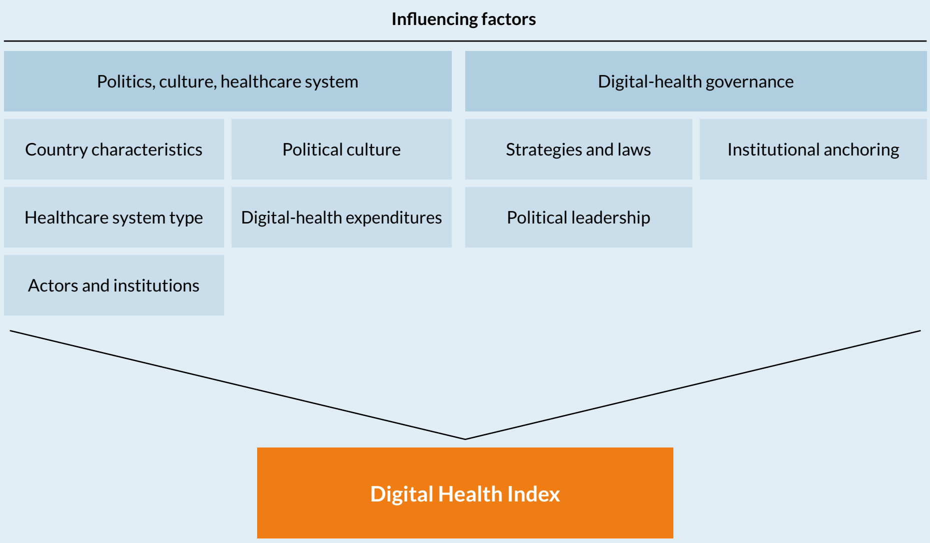
This is where Part II of this study comes in. This section takes a more pragmatic approach, insofar as it embeds historical descriptions in an analytical context or narrative, using interviews and research – a *process tracing*, as described below. On the other hand, it also develops a simple impact model that reviews the hypothetically most important variables for the explanation of successful digitalization strategies through reference to the country studies being compared.

2.2.2 Impact model for healthcare system digitalization

While the Digital Health Index in Part I offers an overall view, Part II aims at providing a more in-depth analysis of the results in five selected countries (Switzerland, Netherlands, Denmark, Israel, France). To this end, we present structured reports describing the various factors influencing each country's state of digitalization. First, the comparison of country-specific success criteria, hurdles, and particular constellations of actors and environmental factors enables us to draw conclusions regarding general derivable channels of impact for digitalization strategies and the grounds for their success. This applies particularly to *lessons learned* and to any reform stimuli, processes, ideas or experiences that could be transferrable to the German system.

The structure of the country reports derives from an impact model developed for this study. The goal of the model is to identify, in the most holistic way possible, the factors that have an influence on healthcare-system digitalization. To this end, we initially distinguish between two blocks in our consideration of each country: "Politics, culture, healthcare system" and "digital health governance."

FIGURE 6: **Impact model Factors influencing the Digital Health Index**



Source: Bertelsmann Stiftung

The first block, "politics, culture, healthcare system," includes objectively comparable criteria to the greatest extent possible. It thus incorporates country-level features such as demography and geography; the specific political system; the relationship between subsidiarity and centralism; the healthcare system type, ranging from social security systems to national health services to a hybrid of the two; the actors and institutions that play a role in the digitalization of the healthcare system; and public expenditures on eHealth.

The second block, "digital health governance," encompasses so-called governance criteria – meaning the totality of the structures and processes for the implementation of digital health systems – as well as strategies and laws, the institutional framework underlying digital health programs, and the country's political leadership.[17]

2.2.3 Variables influencing the national-level state of digitalization

As a next step, the project team drew on these theoretical reflections to expand the impact model with indicators related to the factors deemed likely to influence the national-level state of digitalization. The influencing variables' expected effect on the state of digitalization was examined following Lang and Mertens.[18]

Indicators and their expected effect

To facilitate this analysis, a country-comparison matrix was created (see table 5). This matrix expanded the previously shown basic factors of influence (variables) with corresponding indicators suspected to hold possible relevance to the state of digitalization and the digitalization process. Of particular interest here were systemic factors such as state and government forms, the size of the country, the participating actors, the country's political culture and attitudes toward potential barriers such as privacy protections, the type of healthcare system, and public expenditures for digital health issues. In this regard, previously existing research into political factors relevant to the implementation of telemedicine in the United States were used as a basis and adapted to the present study.[19] In addition, more recent metastudies[20] covering a larger number of research projects were also used as sources. The governance factors in particular were given careful regard: For example, additional factors such as leading political figures' attitudes toward the topic, or efforts to manage programs using targeted political measures, were selected. The selected factors were then examined, using existing literature on the expected effect of influencing variables on the state of digitalization as a guide. The expected effects ranged from very negative (⊖⊖), negative (⊖) and neutral (⓪) to positive (⊕) and very positive (⊕⊕). We address the individual indicators and their expected effects below.

17 This refers to the government's role in directing governmental consensus-building and decision processes, as well as top political-executive representatives' function in producing political legitimacy for government decisions (Jean Blondel, Political Leadership: Towards a General Analysis, London 1987). Other approaches to political leadership ask about the conditions under which such leadership can implement its preferences particularly effectively, as well as, where appropriate, about opportunities for optimizing political-leadership performance (Helms, L. (2009) Politische Führung in der Demokratie: Möglichkeiten und Grenzen der vergleichenden Forschung. *Zeitschrift für Politik.* 56, pp. 375-396).

18 Lang, A. & Mertes, A. (2011): E-Health Policy and Deployment Activities in Europe. *Telemedicine and e-Health.* 17 (4), pp. 262–268, DOI: 10.1089/tmj.2010.0174.

19 Schmeida, M, McNeal, R, Mossberger, K (2007): Policy determinants affect telehealth implementation. *Telemed J E Health 13,* pp.100-107, DOI: 10.1089/tmj.2006.0017.

20 Ross, J., Stevenson, F., et al. (2016): Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update). *Implementation Science.* 11, DOI: 10.1186/s13012-016-0510-7.

TABLE 5: **Factors influencing the state of digitalization**

Variables	Indicators	Expected effect
Political and social system		
Country characteristics	Country size and population	– –
	State and government form	0
	Political order: Centralism vs. federalism and subsidiarity	–
	Corporatism (degree of self-government)	– –
Political culture	Compromise and consensus	+
	Role and cultural embeddedness of data-privacy protections	– –
Healthcare system type	Financing system: Social-insurance system (Bismarck) vs. state-run health service (Beveridge) vs. hybrid system	+ +
	Regional / municipal vs. national organizational structure	– –
Digital health expenditures	Public expenditures for digital health issues	+
Actors and institutions	Constellations of actors and advocacy coalitions: Number and role of veto actors	– –
Digital health governance		
Strategies and laws	Number of strategies and laws	+
	"Quality of legislation"	+
	Mandated use of standards and interoperability solutions	+ +
	Role of digital health strategies	+ +
Institutional embedding	Secured financing for national / regional digital health competence centers (e. g., for staffing purposes)	+ +
	Centralized political management structure in place	+ +
	Involvement of diverse stakeholders / interest representatives, as well as patients, advisory councils	+
Political leadership	Commitment and involvement	+ +
	Coordination	+ +

Source: Bertelsmann Stiftung

The following assumptions were made regarding individual variables:

Country size and population: The bigger a country, the more complicated the process of digitalization. Therefore, with increasing country size and population, the state of digitalization declines. Expected effect: – –

State and government form: The state and government form has neither a positive nor a negative effect on the state of digitalization. Expected effect: 0

Political order: Centralism vs. federalism and subsidiarity: Due to increased political complexity, an environment of pronounced federalism and subsidiarity has a negative effect on the state of digitalization. The greater the degree of federalism, the worse the state of digitalization. Expected effect: –

Corporatism (degree of self-government): The greater the degree of self-government and the associated complexity, the worse the state of digitalization. Expected effect: – –

Compromise and consensus: Positive social attitudes toward compromise and consensus, particularly within the political discourse, facilitate the introduction of digitalization; the greater the willingness to compromise, the better the state of digitalization. Expected effect: ⊕

Role and cultural embeddedness of data-privacy protections: Data-privacy concerns can strongly hinder digitalization processes, having a very negative effect on the state of healthcare-system digitalization; the more significant these concerns, the worse the state of digitalization. Expected effect: ⊖⊖

Financing system: Social-insurance system (Bismarck) vs. state-run health service (Beveridge) vs. hybrid system: The type of healthcare system plays a major role with regard to the implementation of digitalization within that system. The more state control over the healthcare service, the better the state of digitalization. Expected effect: ⊕⊕

Regional / municipal vs. national organizational structure: As with the issue of self-government, the more pronounced the regional and municipal organization of the healthcare system, the worse the state of digitalization. Expected effect: ⊖⊖

Public expenditures for digital health issues: It is assumed that increased public expenditure on digital health issues is positively correlated with the state of digitalization; the greater the expenditure, the better the state of digitalization. Expected effect: ⊕

Constellations of actors and advocacy coalition:[21] Number and role of veto actors – various alliances of actors such as interest groups, citizen initiatives, and so on can represent their perspectives as cohesive groups. The more actors with strong veto power, the more negative the effects. Expected effect: ⊖⊖

Number of strategies and laws: It is assumed that the presence of digital health strategies and laws has a positive effect on the state of healthcare-system digitalization; the more strategies and laws, the better the state of digitalization. Expected effect: ⊕

Quality of legislation: Well-written, simple digital health / digitalization laws are conducive to digitalization; the simpler / less complicated the eHealth laws, the better the state of digitalization. Expected effect: ⊕

Mandated use of standards and interoperability solutions: Requirements for the use of standards and interoperability solutions help create unified technical frameworks and facilitate digitalization; the more the use of standards is required, the better the state of digitalization. Expected effect: ⊕⊕

Role of digital health strategies: As an addition, the content of digital health strategies is assessed here. The more concrete the strategies with regard to setting goals, creating framework agreements and allocating funds, the better the state of digitalization. Expected effect: ⊕⊕

Secured financing for national / regional digital health competence centers: The presence of state-supported digital health competence centers has an extremely positive effect on digitalization;

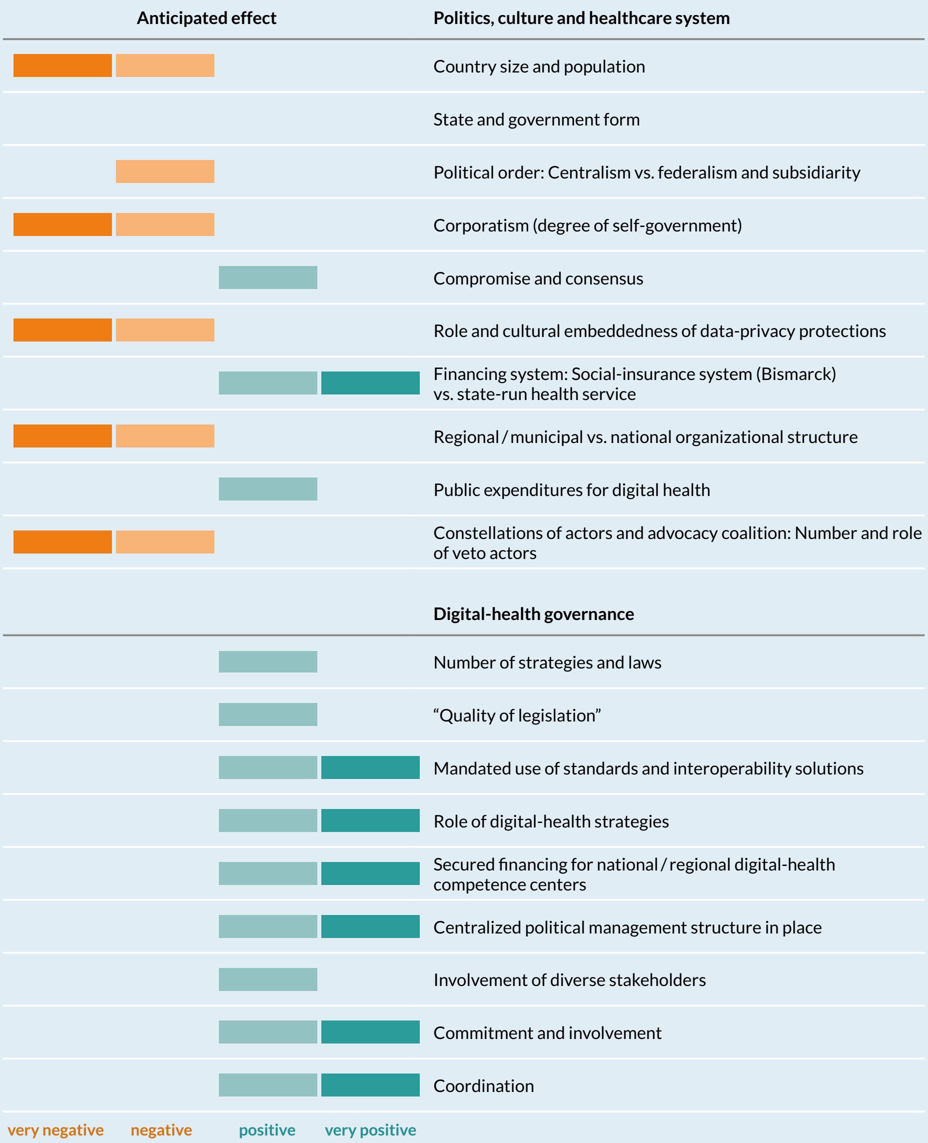
21 The term "Advocacy Coalition" (the English "advocacy" here corresponding to the German "Eintreten") is defined in political science as the following: "[I]n der Politikwissenschaft, ein Bündnis verschiedener politischer Akteure innerhalb eines Policy-Netzwerkes." ("In political science, a group of varied political actors within a policy network"; the English-language Wikipedia does not have a corresponding entry.) These actors, whether parties, interest groups, citizens initiatives, journalists or academics, are unified by a common political goal. An advocacy coalition does not act as a closed group. Often, it is not immediately obvious who belongs to such an advocacy coalition. It is only the substantive action in support of the particular goal that determines this as a coalition. An example of an advocacy coalition could be media campaigns supporting a political process (Dieter Nohlen, Rainer-Olaf Schultze (Eds.): Lexikon der Politikwissenschaft. Volume 1, A-M; München 2004; p. 4).

the higher the level of financing / the greater the number of competence centers, the better the state of digitalization. Expected effect: ⊕⊕

Centralized political management structure in place: The existence of politically established committees or other institutions to manage the digitalization process has an extremely positive effect; the more competences held by these committees / institutions, the better the state of digitalization. Expected effect: ⊕⊕

Involvement of diverse stakeholders: The involvement of different stakeholders is recognized as a necessary factor; the more stakeholders are involved, and the more tightly they are integrated into the process, the better the state of digitalization. Expected effect: ⊕

FIGURE 7: **Anticipated effect of influencing variables on the state of digitalization**



Source: Bertelsmann Stiftung

Commitment and involvement: The more active and involved top political leaders are in the area of digital health, the more positive the effects on the digitalization process, and ultimately on the state of digitalization. Expected effect: ⊕⊕

Coordination: Proactive political measures have a major effect with regard to digitalization of the healthcare system; the more measures are implemented, the better it is for the digitalization process. Expected effect: ⊕⊕

The assumptions made here are made in general terms and are individually reviewed on a hypothetical basis for each individual country report. A graphic presentation format has been chosen for this purpose (see figure 7). This shows the assumptions made here in the form of colored bars, ranging from very negative (dark orange) to very positive (dark green). The graphic below describes the above-noted individual indicators' expected effects on the state of digitalization.

Over the course of the study, this graphic will be additionally used in the individual country chapters to visually present the actual observed effect. We will return to it again in the analysis chapter in order to compare the expected and observed effects, and to draw general conclusions regarding the importance of individual factors.

Additional country-based digitalization and technology factors

In addition to the country-comparison matrix and the factors and indicators holding a significant degree of influence, two additional digitalization and technology factors were incorporated: the Networked Readiness Index (NRI) and the results from the Eurobarometer survey on the issue of data-privacy protection. These two factors are used as additional indicators in the analysis of the individual countries; however, as they do not stem originally from our work, they are presented externally, and are not given significant weight in the observation of the individual countries.

Networked Readiness Index

The Networked Readiness Index (NRI), a part of the Global Information Technology Report, represents a means of testing countries' readiness to take advantage of emerging technologies and capitalize on the opportunities provided by the digital transformation. The report assesses factors, policies and institutions intended to help individual counties use ICT to boost progress and growth. To this end, the countries are evaluated in four areas:

1. the general environment for the use and development of technology (political, regulatory, economic, and degree of innovation-friendliness),
2. technological readiness with respect to ICT infrastructure, affordability and capabilities;
3. acceptance and use of technology in three key areas (within the government administration, within private businesses, and among private individuals); and
4. the economic and social effects of new technologies.

In total, the NRI consists of 53 indicators from four sub-indices: Environment, Readiness, Usage and Impact.[22]

22 Baller, S., Dutta, S., Lanvin, B. (2016). The Global Information Technology Report 2016 – Innovating in the Digital Economy. World Economic Forum. Geneva

TABLE 6: **Networked Readiness Index**

	2015 ranking		2016 ranking
Netherlands	4	↓	6
Switzerland	6	↓	7
Denmark	15	↑	11
Germany	13	↓	15
Israel	21	→	21
France	26	↑	24

Source: Baller, S., Dutta, S., Lanvin, B. (2016). *The Global Information Technology Report 2016 – Innovating in the Digital Economy.* World Economic Forum, Geneva.

For this study, the results of the NRI serve as an additional indicator for the review of technological preconditions for digital health systems. The assumption here is that the NRI offers insights particularly regarding the political and technological conditions in each country, and thus serves as a reference point in assessing the state of digitalization. At the same time, it should be noted that the NRI is not explicitly applicable to the digital health sector; rather, it addresses only fundamental tendencies regarding the political and regulatory environment, the infrastructure, the use of technology, and its impact. Digital health is in this regard only one aspect of this broader picture; however, it is explicitly considered by the NRI as an indicator for the social impact of ICT use. The following table shows an excerpt of the index containing the five countries examined by this study, along with Germany.

Citizen trust in medical and healthcare-sector institutions

In the course of our research and study-related trips, we encountered frequent mention of privacy and data-protection factors. In order to be able to address this variable as objectively as possible, and to enable us to assess its influence on the state of digitalization, we have additionally incorporated the answers to question 18.4 from the EU Barometer survey on the topic of data protection:[23]

“Different authorities (government departments, local authorities, agencies) and private companies collect and store personal information about you. To what extent do you trust the following authorities and private companies to protect your personal information?”

TABLE 7: **Trust in medical and healthcare-sector institutions**

	Total “Trust”	Total “Don’t trust”
EU-28	74%	24%
Denmark	89%	10%
Germany	77%	21%
France	79%	17%
Netherlands	81%	18%

Source: TNS Opinion & Social; DG JUST; DG COMM (2015). Special Eurobarometer 431 – Data Protection. European Commission, Brussels.

23 TNS Opinion & Social; DG JUST; DG COMM (2015). *Special Eurobarometer 431 – Data Protection.* European Commission, Brussels.

Unfortunately, neither Switzerland nor Israel are represented in the Eurobarometer, which somewhat diminishes the significance of this indicator; nevertheless, the answers provide some hints for the remaining countries regarding the role of data-privacy protections in the implementation of digital health programs. Table 7 presents the results from the participating countries. In each of the country reports, data-privacy concerns are addressed to the degree that these are known and are compared with the Eurobarometer results in order to assess the importance of data protection for the digital health sphere.

2.2.4 Methodology and approach

Brief overview

The methodology for the systematic comparison of digitalization strategies is divided into three areas: the literature analysis, the impact model, and the data collection and interviews. After extensive research in the existing literature, both in English and the subject countries' local languages, a large body of articles, reports and websites was selected, and analyzed with regard to the impact model. The theoretical and empirical work on causes, conditions, success criteria, and barriers to digitalization strategies was given crucial support by a) the structured data collection performed by the national correspondents as described in Part I of this study, and b) 19 in-depth, on-the-spot interviews with experts and representatives of the various national eHealth environments.

Process tracing and grounded theory

Methodologically, this part of the study is based fundamentally on two concepts: *process tracing* (PT) and *grounded theory* (GT). PT is a method designed to track and identify causal mechanisms, highlighting the way they play out in practice with the help of detailed case studies. In political science, this method is used to develop theories for fields of inquiry in which there is as yet no scientific foundation. In this regard, the analytical focus is placed on understanding processes, their causes and the causal relationships between them. In other words, it inquires into the what, the why and the how. As an initial step, the processes to be investigated are decomposed into their component elements and operationalized, and the expected manifestations determined for a specific case. The development of the theory includes a bottom-up search in the empirical records, in the course of which existing knowledge is meant to be used as inspiration for systemic patterns. [24, 25, 26]

GT is a framework concept from the social sciences. It is not a single method in itself but is instead a series of interlocking procedures for the systematic evaluation of primarily qualitative data, with the goal of generating theory. "Grounded," in this case, refers to the anchoring of the theory-development process in the data. Analysis and theory are meant to have a reciprocal relationship to one another. Following the maxim "all is data," the actual research process begins with the collection of knowledge regarding the research field and the initial question. The literature review serves as the first clarification and formulation of the direction to be taken in the subsequent research process. The initial relationships

24 Beach, D. and Pedersem, R. (2016). *Causal Case Study Methods.* Ann Arbor, United States: University of Michigan Press.

25 Bennet, A. and Checkel, J. (2014): *Process Tracing. From Metaphor to Analytic Tool.* Cambridge, United Kingdom: Cambridge University Press.

26 Schimmelfenning, F. (2006): Prozessanalyse. In: Behnke, J. Gschwend, T., Schindler, D. and Schnapp, K.-U., Eds, *Methoden der Politikwissenschaft. Neuere qualitative und quantitative Analyseverfahren,* Baden-Baden, Deutschland: Nomos, pp. 263-271.

between concepts and variables (e.g., healthcare system type, political culture or digital health strategy) are conceived, and the quality of the relationships is described.

In a further step, data can then be collected. For the present study, multiple exploratory interviews were conducted on the issues of empirical data collection, the construction of national policy-field analyses, and digital health case studies. The interviews' general direction and questions were based in part on the literature research and the variables derived from it; however, they also offered the opportunity to speak openly about complex topics. Conversely, the interviews also served to solidify or reorient the relationships between the variables. In the terms of the GT framework, this performed using the constant comparative method. Ultimately, this analytical process can produce similar and differing relationships between the defined variables, which are identified, compared and described in greater detail. This result is used to derive rough theoretical concepts, which are highlighted at the end of the country studies.[27, 28]

Study trips and exploratory interviews

In each of the countries examined in depth – Switzerland, Netherlands, Denmark, Israel and France – we conducted four to six local interviews. These interviews had the following average distribution: two representatives from national ministries or healthcare-data or digital health authorities, two representatives from the academic research world or independent digital health-related research institutions, and two representatives from trade associations or healthcare providers.

In Switzerland, we interviewed individuals coming from the medical profession and from universities. In addition, we spoke with figures from the relevant coordination bodes and interior departments, both at the national and cantonal level. For the study trip in the Netherlands, we were able to speak to experts from the digital health authority and from the public-health research field. In Denmark, we spoke with representatives of sundhed.dk, Sundhedsdatastyrelsen and the Innovation Center of the Odense University Hospital. In Israel we visited with the two largest of the four health maintenance organizations (HMOs) and interviewed a number of researchers. In France too, we interviewed public-health researchers and representatives of ASIP Santé.

In order to facilitate a more open exchange, and also to be better able to gather information on political and causal mechanisms related to the successes and failures of the countries' national digitalization strategies, we agreed to terms of confidentiality for all our interview partners.

The following summarized overview of our interviewees can confirm the interviews as reliable sources:

- Denmark: Danish eHealth portal (Sundhed.dk), national authority for healthcare data (Sundhedsdatastyrelsen), university hospital innovation center in Odense
- France: National eHealth agency (ASIP Santé), AP-HP hospital association
- Israel: Maccabi Health Services, Clalit Health Services, Ministry of Health's digital health initiative

27 Charmaz, K. (2010). Constructing *grounded theory. A practical guide through qualitative analysis.* Los Angeles, California: Sage Publications Ltd..

28 Strauss, A. and Corbin, J. (1990). *Basics of Qualitative Research. Grounded Theory Procedures and Techniques.* London, United Kingdom: Sage Publications Ltd..

- Netherlands: Nationale eHealth-Behörde (NICTZ), Universitätsklinikum Amsterdam
- Switzerland: National eHealth authority (eHealth Suisse), Federal Office of Public Health, Swiss Medical Association (FMH), Swiss Conference of Cantonal Healthcare Directors (GDK)

We will detail the implementation of the theoretical and methodological approach described in this chapter (referencing Part II of the overall study) below, in chapter 5. However, before doing so, we will initially address the results of Part I, beginning with the state of digitalization at the country level. This state of digitalization is the comprehensive country-focused result of the benchmarking process, while the subsequent chapter 3 presents the Digital Health Index with its ranking and direct comparison of all 17 countries.

3 Country reports: State of digitalization in each country

This chapter presents and describes the findings for the benchmarking process and introduces the Digital Health Index. It contains short evaluations of the countries surveyed, each of which includes a map of digitalization and a digitalization profile, as well as a brief comparison with the state of digitalization in Germany. The evaluations of each country are based on findings from the Digital Health Index.

The chapter following presents the key findings from the benchmarking process in the form of the Digital Health Index country rankings and other statistical findings. These are linked with and supplemented by a cross-national summary of the state of digitalization.

3.1 Introduction and approach

The structure of the following 17 country reports follows a pattern based mainly on the questionnaire: First, each report provides key data on a country's healthcare system. Drawing on desk research, each report then presents the digital health activities and developments observed in each country over the last five to 10 years. The questionnaire results for each sub-index are also described. The findings for sub-indicators such as "policy activity" and "readiness" are presented in separate thematic blocks that include contextual information and comments made by the national correspondents interviewed for the project.

Explanation of the digital health map

Each country report includes a graphical representation of the Digital Health Index findings. This "digital health map" provides an overview of digital health elements found in a country on three levels.

The enablers, that is, those elements that are required for digital health to take off, comprise the first level. This includes factors like a legal framework for digital health and the extent to which digital health is institutionally anchored. Data protection regulations and technical as well as semantic standards are cornerstones of the legal framework. In exploring the extent to which digital health is institutionally anchored, we have examined key issues such as the financial resources provided to institutions and whether or not a national digital health authority has been established.

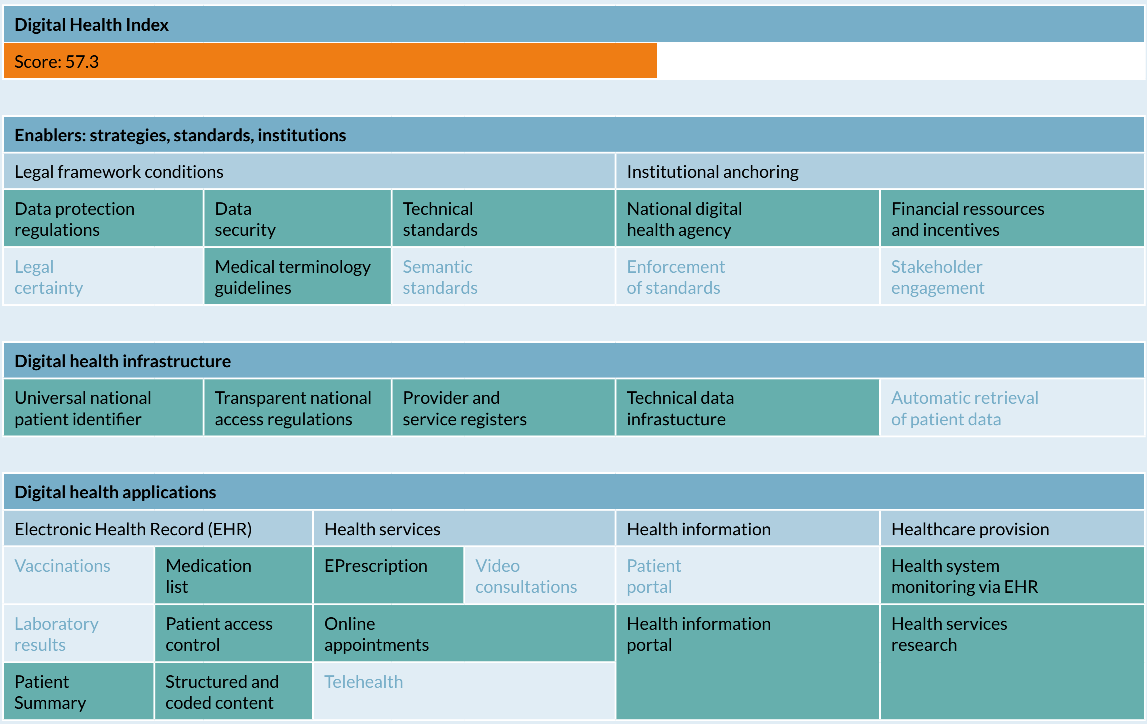
The second level of analysis explores the various modules that make up a digital health infrastructure, for example, a national system of unique patient identification numbers.

The third level of analysis addresses digital health applications, divided into four categories: “electronic health records,” “healthcare services,” “health information,” and “healthcare provision.” Each module maps various functions within each area, such as ePrescriptions, telehealth or online appointment booking.

Each digital health map features white- and green-shaded fields. Each field represents an issue or aspect addressed by the survey’s questions and indicators. Items in green-shaded fields are present and available throughout the entire country, whereas items in the white-shaded fields are either not available or available only in discrete areas. This was determined through a qualitative analysis of each module in each country. Exclusively national and not regional levels of uptake were taken into consideration here.

Figure 8 illustrates the makeup of a digital health map. Each green-shaded field represents an item that is available nationally, and the white-shaded fields represent those items that are not available throughout the entire country. If, for example, an item is available only within a specific region, its field is shaded white.

FIGURE 8: **Example of a digital health map**



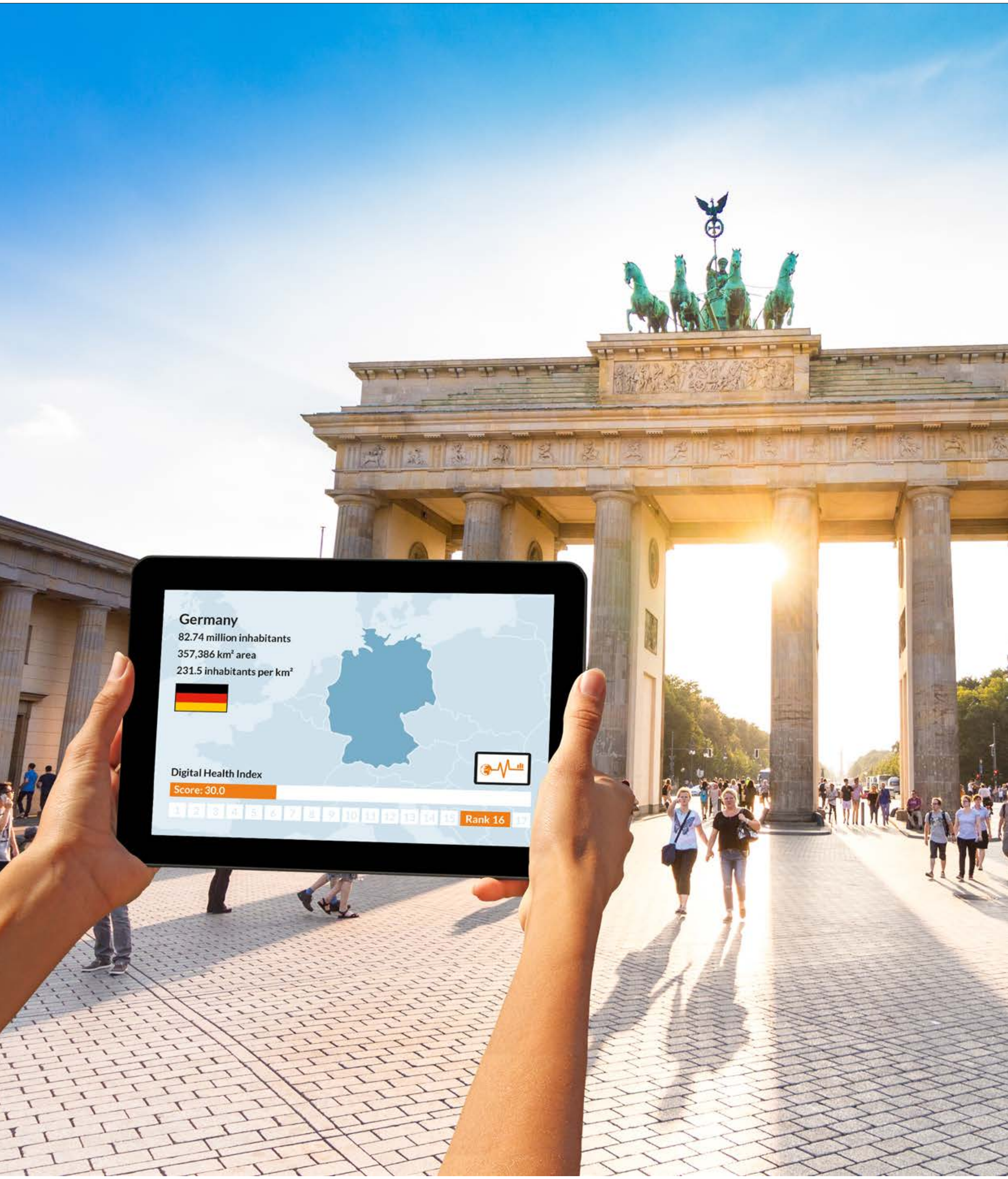
■ available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

Digitalization profile

In addition to a digital health map, each report features a graphic representation of the individual indicators used to assess the country. These digitalization profiles are presented in a table that includes the scores for each indicator. Between one and five points are awarded for each indicator, based on the percent of total points attained. Further details regarding the evaluations underpinning these digitalization profiles and their representation are provided in the methodology section.

Comparison with Germany

In order to establish linkages between digital health developments internationally and those in Germany, each country is compared with Germany in terms of their respective Digital Health Index results. The three sub-indices – policy activity, digital health readiness and actual use of data – are represented in a bar chart featuring color-coded columns.


Germany
82.74 million inhabitants
357,386 km² area
231.5 inhabitants per km²
Digital Health Index
Score: 30.0
Rank 16

3.2 Germany

The following report on Germany is based on both the results of our benchmarking process and additional research. The structure and scope of this report, as well as the issues it addresses, are presented following the same template used with the other 16 country reports. The content of this report draws primarily on the findings and structure of our international survey and its underlying questionnaire. In order to ensure comparability, the state of healthcare digitalization in Germany is presented in the same form as the other country reports.

At the end of this study, we provide an interpretation of the current digital health situation in Germany and its classification on international comparison.

3.2.1 The national healthcare system

In Germany, the nation that invented the concept of a national health insurance system under Bismarck in 1883, the federal government sets the conditions determining medical care throughout the country. This principle of agenda control was designed, in part, to ensure solidarity and has been anchored in Germany's Basic Law since the founding of the Federal Republic in 1949. At the same time, however, the country's national healthcare system is underpinned by the principles of decentralization and self-governance, which results in formal responsibility for the provision of healthcare resting on the shoulders of the individual federal states (Länder). This means that each federal state in Germany is tasked with planning and financing hospital care for their constituencies. The responsibility, however, of carrying out and providing healthcare as stipulated by law and in accordance with regulations, is delegated to the so-called self-governing partners (i.e., health insurance funds and physicians). Since 1996, when legislation designed to introduce competition mechanisms into the landscape of health insurance funds was implemented, German residents have been able to choose among 110 statutory health insurance providers (gesetzliche Krankenversicherungen, GKV). Statutory health insurance provides coverage for all employees with an annual income below € 59,400, as well as pensioners, the unemployed and those receiving social security benefits. Parents who are not in the labor market and children are co-insured without premiums. Currently, some 86.5 percent of the population are included in a statutory health insurance scheme, another 10.6 percent are covered by a private health insurance program and around 2.8 percent either have no insurance or are covered by some other arrangement. In 2016, government spending on the health system accounted for 11.3 percent of GDP, making it the most expensive system in Europe after Sweden and France.

In principle, income-dependent contributions to statutory health insurance funds are made by their members, employers and pension insurance carriers or other agencies. Since co-payments for medicine and physio rehabilitation are capped at a maximum of 2 percent of gross household income, they play only a minor role in Germany.[29] Whereas benefits-in-kind underpin statutory health insurance funds and their exhaustive catalogue of services, privately insured persons must first pay for services and then submit the invoice to their insurance provider for reimbursement. Although physicians are supposed to play the role of gatekeepers, patients can also go directly to outpatient specialist care. Hospital

29 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: 2nd edition. Medizinisch wissenschaftliche Verlagsgesellschaft.

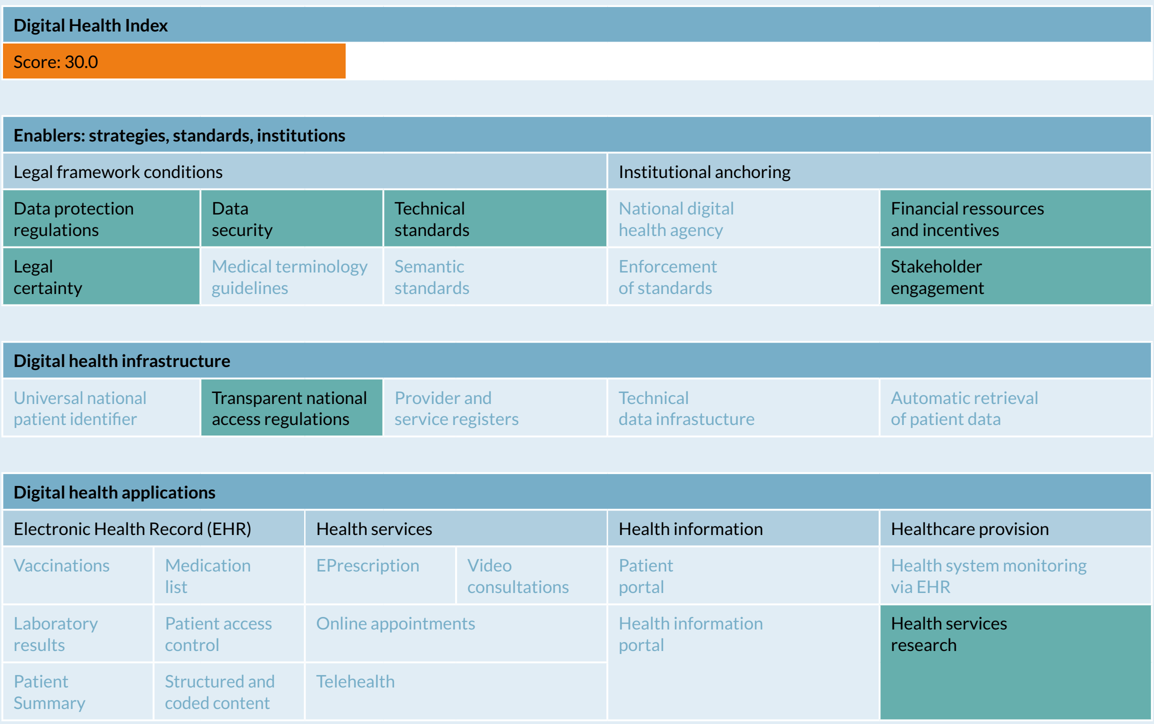
treatment must first be deemed necessary by an outpatient physician who then provides a referral. In the event of an emergency, patients can seek emergency care at a hospital directly. Overall, the trend toward increasing numbers of self-admittances in hospitals is growing.

3.2.2 Development of digital health

Figure 9, a map of digital health in Germany, summarizes the elements of digital health that are present in the country, as identified in the course of this study (green-shaded fields).

These maps have been discussed in the introduction to the country studies. However, in order to facilitate readability, we offer additional information regarding some of the elements in the digitalization profile for Germany provided below: Each field within the map represents a specific issue or element addressed by a question or indicator in the survey. Items in green-shaded fields are present and available throughout the entire country, while items in white-shaded fields are either only partially available or have not been implemented. If, for example, an item is available only within a specific region, its field is shaded white.

FIGURE 9: **Map of digital health in Germany**



■ available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

3.2.3 Policy activity and strategy

Together with the principle of self-governance, the federal government's legal power to set the conditions for healthcare results in many, to some extent contradictory, political measures and positions taken on the issue of digital health in Germany. A cohesive overarching strategy and shared vision that coherently encompass the relevant areas to be targeted by research and the question of mobile health applications (mHealth) have yet to be formulated.

Digital health strategies

As part of its eHealth initiative, the Federal Ministry of Health has held regular meetings since 2010 with a number of stakeholders to identify and address implementation hurdles to digital applications such as telemedicine. At these meetings, the government and stakeholders have developed various measures designed to reduce these barriers. The stakeholders generally include all self-governing bodies involved with providing standard healthcare as well as the major associations representing companies that provide ICT and IT solutions for the healthcare sector. The most significant outcomes of these meetings include a national telemedicine portal, a list of criteria for projects addressing the future of eHealth and a planning report on interoperability. The key elements of this report are reflected in Germany's eHealth Act.

Since this legislation went into effect in 2016,[30] Germany has had a federally driven plan of action to establish digital health throughout the country. The plan focuses on using telematics infrastructure as the healthcare system's digital backbone while prioritizing patient benefits and maximum data protection. The federal government has delegated responsibilities and decision-making authority for specific items (e.g., the electronic health professionals registry) to the federal states and self-governing organizations. The Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH (gematik), a firm whose shareholders represent leading healthcare bodies in Germany, acts as an institution of bundled expertise in the area of digital health.[31]

There is general awareness within Germany's mainstream parties of the key role of digital health services and applications for the quality and efficiency of the healthcare system.

In addition to introducing the telematics infrastructure and the health record system for the exchange of patient data across the country, the federal government's coalition agreement between the Christian Democrats (CDU/CSU) and the Social Democrats (SPD) for the current legislative period announces plans to build a health information portal that will provide quality-assured and objective information on illnesses and other health matters. The coalition agreement also calls for the creation of new certification procedures for digital applications and the need to reduce barriers to remote treatment.[32] But no specific strategy to facilitate technical and semantic interoperability has been announced to date. However, gematik's recently established directory for technical and semantic standards – vesta – marks a step in the right direction.

30 *Gesetz für sichere digitale Kommunikation und Anwendungen im Gesundheitswesen (E-Health-Gesetz) 2015.*
31 gematik.de (2018). *Gesetzliche Grundlagen.* [online] Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH. Available at: https://www.gematik.de/ueber-uns/gesetzliche-grundlagen/.
32 Bundesregierung (2017). *Koalitionsvertrag zwischen CDU, CSU und SPD. Entwurf.* [pdf] Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwj0zsXFrtDcAhWI-6QKHZOEAksQFjAAegQIBRAC&url=https percent3A percent2F percent2Fwww.proasyl.de percent2Fwp-content percent2Fuploads percent2F2015 percent2F12 percent2F2018-02-07-Koalitionsvertrag-Union-SPD.pdf&usg=AOvVaw3hLz734yMbEd_ffQwGmlGu.

There are no comprehensive, binding targets, guidelines or deadlines for a digital healthcare system as a whole. But the eHealth Act does regulate specific applications individually: As of January 1, 2021[33] insured individuals have the right to an electronic health record (EHR) that stores key documents such as referrals, medication plans, information in the event of an emergency and vaccination records in digital form. In order to access these files, a physician will need to have an electronic physician's ID card (eHBA).[34] In addition to the electronic health record, the electronic patient record (ePF) was initially scheduled to be made available to patients by January 1, 2019 and was designed to "mirror" health information in the electronic health record. Current work on the Appointment Service and Care Act (Terminservice- und Versorgungsgesetzes, TSVG) is revising stipulations regarding control over access to the electronic health record.[35] The two-key authorization process that has been in use so far will remain as an option, but patients should be able to access their EHR without having their physician authorize access as well through their professional ID. In this way, the EHR and electronic patient record will merge their content.[36] The eHealth Act provides for budget cuts (5 percent to 10 percent) if gematik's shareholders – that is, the National Association of Statutory Health Insurance (KBV), the German Federal Association of Sick Fund Dentists (KZBV) and the National Association of Statutory Health Insurance Funds (GKV-Spitzenverband) fail to meet specific deadlines for the introduction of new applications.[37]

The eHealth Act also regulates telemedicine services and the introduction of a medication plan.[38] It set July 31, 2017 as the deadline for the introduction of video consultations to be provided by SHI-authorized physicians. Fees for such services were also determined. The National Association of Statutory Health Insurance and the National Association of Statutory Health Insurance Funds (KBV and GKV-Spitzenverband) have agreed to pay individual practices up to € 800 annually for each physician offering patients video consultations. Since April 2017, practices can charge a technology surcharge of € 4.21 for each consultation for up to 50 sessions in a quarter.[39] For the time being, however, this regulation applies to only specific types of physicians such as general practitioners or paediatricians and particular specialists such as dermatologists, opthalmologists, surgeons and orthopedists. Because the KBV and GKV-Spitzenverband's evaluation committee considers video consultations to be appropriate only for certain types of conditions, services provided are renumerated only when specific symptoms are present. This includes visually monitoring operation wounds, skin disorders and musculoskeletal disorders or restrictions to the movement of some aspect of the musculoskeletal system and includes a consultation.[40]

For German lawmakers, the TSVG marks a new attempt to introduce the electronic health record nationwide. In the draft bill, the deadline for introducing a gematik-certified electronic health record has been extended to 2012 and the statutory health insurance funds

33 The TSVG ministerial draft bill has extended the deadline from 2019 to 2021 (see below).
34 bundesaerztekammer.de (2018). *E-Health-Gesetz.* [online] Bundesärztekammer. Available at: https://www.bundesaerztekammer.de/aerzte/telematiktelemedizin/earztausweis/e-health-gesetz/.
35 This was a draft bill at the time of this writing; any adaptations that have since been made were not available for consideration.
36 *Entwurf eines Gesetzes für schnellere Termine und bessere Versorgung (Terminservice- und Versorgungsgesetz – TSVG) 2018.*
37 bundesaerztekammer.de (2018). *E-Health-Gesetz.* [online] Bundesärztekammer. Available at: https://www.bundesaerztekammer.de/aerzte/telematiktelemedizin/earztausweis/e-health-gesetz/.
38 *Gesetz für sichere digitale Kommunikation und Anwendungen im Gesundheitswesen (E-Health-Gesetz) 2015.*
39 kbv.de (2017). *Vergütung für Videosprechstunde geregelt – Start schon im April.* [online] Kassenärztliche Bundesvereinigung. Available at: http://www.kbv.de/html/1150_27150.php.
40 kbv.de (2017). *Vergütung für Videosprechstunde geregelt – Start schon im April.* [online] Kassenärztliche Bundesvereinigung. Available at: http://www.kbv.de/html/1150_27150.php.

are required to offer these records to their insurees. According to the bill, gematik is to be commissioned under the auspices of the Federal Office for Information Security to establish the framework for the technical requirements needed for video consultation access and authentification as well as develop a certification procedure for commercial mobile devices and services by March 31, 2019.[41]

There are several actors involved with policymaking that addresses the digital transformation of healthcare. This includes gematik's advisory board, which issues public statements on key issues and acts as an advisory body to the public in general. Members include representatives from each federal state, representatives of patient organizations, health sector leaders, healthcare academics and representatives from professional organizations in the field.[42]

Institutional anchoring, financing and legal framework

Although there are legislative plans for the National Association of Statutory Health Insurance Funds to take on financial responsibility for the digitalization of Germany's healthcare system, the government has not allocated for a digital health budget or established a dedicated digitalization authority. gematik's mandate is limited to developing the telematics infrastructure and the electronic patient card. However, recent developments in German politics suggest a growing desire to reform: Federal Health Minister Jens Spahn (CDU) established a digitalization department within his ministry[43] that is tasked with resolving complexity-related problems and fostering the policy consensus needed to ensure that telecare services are adopted everywhere and in rural regions in particular.[44]

Small- and medium-sized enterprises in the digital health sector have access to limited funds that are made available to each individual federal state. These include initiatives such as egesundheit.nrw[45] or the state of Hessen's E-Health Initiative.[46] Some resources were also made available for a short period through an innovation fund administered by the Federal Joint Committee, the highest decision-making body within Germany's healthcare system, that focused on telemedicine, telematics and eHealth.[47] Generally, physicians themselves are not responsible for financing access to the telematics infrastructure that is under development; instead, health insurance funds will have to bear these costs in full.[48] Given the major delays in rolling out the telematics infrastructure, timetables drawn up in the eHealth Act are already outdated and need to be revised.

41 *Entwurf eines Gesetzes für schnellere Termine und bessere Versorgung (Terminservice- und Versorgungsgesetz – TSVG) 2018.*

42 gematik.de (2018). *Die Gremien der gematik.* [online] Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH. Available at: https://www.gematik.de/ueber-uns/gremien/.

43 aerztezeitung.de (2018). *Neuer Abteilungsleiter für Digitalisierung.* [online] ÄrzteZeitung. Available at: https://www.aerztezeitung.de/praxis_wirtschaft/e-health/article/960508/bundesgesundheitsministerium-neuer-abteilungsleiter-digitalisierung.html.

44 Klein, M. (2018). *Minister-Premiere bei der conhIT: Jens Spahn gründet Abteilung für Digitalisierung im BMG.* [online] eGovernment Computing. Available at: https://www.egovernment-computing.de/jens-spahn-gruendet-abteilung-fuer-digitalisierung-im-bmg-a-710233/.

45 egesundheit.nrw.de (2018). *eGesundheit.nrw.* [online] ZTG Zentrum für Telematik und Telemedizin GmbH. Available at: https://egesundheit.nrw.de/.

46 ehealth-in-hessen.de (2018). *E-Health-Initiative Hessen.* [online] E-Health-Initiative Hessen. Available at: https://www.ehealth-in-hessen.de/Initiative.

47 Gemeinsamer Bundesausschuss (2018). Innovationsfonds. Förderbekanntmachung vom 08. April 2018. Available at: https://innovationsfonds.g-ba.de/downloads/media/9/2016-04-08__Foerderbekanntmachung__nF__offen.pdf.

48 kbv.de (2018). *Telematikinfrastruktur.* [online] Kassenärztliche Bundesvereinigung. Available at: http://www.kbv.de/html/telematikinfrastruktur.php.

Books V and X of the German Social Code (Sozialgesetzbuch, SGB) address explicitly but not exclusively the handling of sensitive patient data in electronic health records. Both books also specify data quality regulations for inpatient data and the quality control mechanisms this requires. The eHealth Act also grants patients a right of access to their data. In other words, patients maintain sovereignty over their data. In addition, Sec. 75 of Book X in the SGB explicity addresses and regulates the use of health data in healthcare research. However, instead of stipulating a regulatory framework, the SGB addresses specific applications within individual medical fields (e. g., cancer or diabetes registries).

Germany's education and vocational training system has yet to integrate curricula that would help medical and other professionals acquire the knowledge and experience needed to manage digital health applications effectively and prepare for the impact of digitalization in their day-to-day work. Some of the regional chapters in the Association of Statutory Health Insurance Physicians (Kassenärztliche Vereinigung, KV) offer digital health training courses,[49] and a few medical schools at German universities feature digital health curricula.

Spotlight: What is gematik?

Headquartered in Berlin, the Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH (gematik) was established in 2005 by Germany's leading healthcare sector organizations. These include, for example, the National Association of Statutory Health Insurance Funds (GKV-SV), the National Association of Statutory Health Insurance (KBV), the German Medical Association (BÄK), the German Federal Dental Chamber (BZÄK), the Federal Union of German Associations of Pharmacists (ABDA), the German Hospital Federation (DKG) and the German Federal Association of Sick Fund Dentists (KZBV). gematik's objective is to build a secure, cross-sector telematics infrastructure for the digital exchange of information in the healthcare industry.[50] This infrastucture is the technical framework needed for electronic health card applications. gematik was established pursuant to legislation passed in 2003 targeting the modernization of statutory health insurance (Sec. 291a para 7 SGB V).

The company defines itself as Germany's hub of expertise and provider of services in digital health matters.[51] Given its legal mandate and the involvement of all key German stakeholders as shareholders (i. e., potential "veto players"), gematik itself is not a driver of political or technological developments. It does bear legal responsibility for three administrative duties, each of which, however, do not involve any coordination in policymaking:[52]

1. gematik defines the functional and technical requirements for telematic infrastructure components and services, which must be secure, interoperable and compatible with each other.

49 kvb.de (2018). *Fortbildungsangebot der KVB.* [online] Kassenärztliche Vereinigung Bayern. Available at: https://www.kvb.de/service/fortbildung/.

50 gematik.de (2018). *Über die gematik.* [online] Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH. Available at: https://www.gematik.de/ueber-uns/.

51 gematik.de (2018). *Gesetzliche Grundlagen.* [online] Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH. Available at: https://www.gematik.de/ueber-uns/gesetzliche-grundlagen/.

52 gematik.de (2018). *Kompetenzzentrum für das digitale deutsche Gesundheitswesen.* [online] Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH. Available at: https://www.gematik.de/ueber-uns/kompetenzen/.

2. gematik is tasked with certifying oving telematics infrastructure components and services and has the authority to certify other electronic applications for use in the telematics infrastructure that lie beyond the scope of the legally specified mandate. The company's certification procedures ensure that components and services (products) comply with standards that are designed to guarantee interoberability in a smoothly functioning telematics infrastructure. Providers are not legally required to use the telematics structure and can develop their own solutions.

3. gematik is charged with determining the operational framework for Germany's telematics infrastructure and monitoring compliance with its established standards. In this sense, it is responsible for the introduction, functionaity and further development of the infrastructure. Industry partners are responsible for the day-to-day operations of the infrastructure.

It is difficult to compare gematik with the national eHealth agencies and management authorities identified in other countries. Given that it has no say in developing strategies for digital health policies and plays no role in coordinating them – indeed, it is limited to recommending certain standards from a technical point of view – it is only marginally involved with national digital health governance.

3.2.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Every German health insurance holder receives from their provider an electronic health insurance card with a unique insurance ID number for use with their physician or for hospital visits. Should the insurance holder switch to a different provider, a part of this number carries over to their new number, allowing it to serve as a national patient ID number. Each physician carries their own unique professional identification card.

To date, the telematics infrastructure has yet to be introduced into routine care. Once the national rollout has been completed, patients can activate on-demand access to their electronic health record while visiting a physician. Security and data protection requirements for processing patients' medical data are very strict.

Generally, compliance with international standards for medical informatics is not mandatory. However, to ensure uniform invoicing, physicans are required to document their data in electronic files in line with the International Statistical Classification of Diseases and Related Health Problems (ICD-10).[53]

gematik has carried out pilot studies to test the electronic patient card in Germany's northwestern region (i.e., Schleswig-Holstein, North Rhine-Westphalia and Rhineland-Palatinate). Because access to future applications within the telematics infrastructure will take place via the electronic patient card, it is important that they be piloted in order to determine how well they work. These pilot tests were monitored and evaluated by scientists at

53 Kvs-sachsen.de, (2018). *Diagnosenverschlüsserung nach ICD-10-GM.* [online] Kassenärztliche Vereinigung Sachsen. Available at: https://www.kvs- sachsen.de/mitglieder/abrechnung/diagnosenverschluesselung-nach-icd-10-gm/

the Friedrich-Alexander Universität Erlangen-Nürnberg (FAU).[54] Another pilot scheduled for the southeastern part of Germany (i.e., Bavaria and Saxony) was initially postponed and then canceled due to a lack of technical components.

Currently, several German health insurance funds are developing and testing electronic medical records: Two major public funds, the AOK and Techniker Krankenkasse, have developed their own systems that they plan to offer their customers. In addition, other public funds such as the BKK, IKK and DAK as well as private insurers such as Allianz use a commercial app. It remains unclear how data flows from primary systems in hospitals and medical practices to actual records will be managed as the projects currently in operation each use different mechanisms. For example, the Techniker Krankenkasse's "TK-Safe" electronic medical record system provides the insured with their billing data in a first step. Because the KV's accounting processes can take anywhere from six to nine months, it can therefore take this long for a patient in this system to be provided their billing data. Billing documents provided by physicians generally contain information such as a diagnosis and the reason for having seen a physician.[55] However, this information is not the same as care provision data.

According to the current ministerial draft of an amendment to Sec. 291 SGB V, once gematik has completed its conceptual planning for the electronic health record (i.e., by the end of 2018, according to the law) and determined the necessary specifications, the statutory health insurance funds must meet these specifications in the records that they have been required to provide as per Sec. 68 SGB V. To date, the only records available throughout Germany are patient summaries for specific conditions (e.g., diabetes) that are used primarily for chronically ill or multi-morbid patients. This includes, for example, disease management programs (DMP) such as the "DMP Diabetes mellitus Typ 2," which helps some 4.2 million diabetes patients in Germany manage their condition.

The first providers began linking up with the telematics infrastructure in the fall of 2017. All practices accredited to a health insurance scheme are required by law to manage insured patient's master data as of January 1, 2019. This system allows medical staff to ensure that data saved on an insured's electronic patient card is current. It also allows them to check other data regarding the patient's insurance plan.

Digital health applications and services

Since October 1, 2016, patients taking more than three prescribed medications have the right to a medication plan developed by their physician.[56] For now, this plan is available only in paper form. Patients can have the plan printed out by their physician and, although the plan features a barcode with information that can be read into prescription systems, it is, at this stage in the process, simply a "container" document without procedural impact. No deadline has been set for the introduction of an electronic version. In 2017, gematik published a set of technical specifications and standards needed for eMedication plans so that companies in the sector can develop the relevant products and submit them

54 Fachportal.gematik.de, (2018). *Evaluationsgutachten zur Fachanwendung Versichertenstammdaten-Management (VSDM).* [online] gematik. Available at: https://fachportal.gematik.de/service/berichte/evaluationsgutachten-vsdm/

55 Tk.de, (2018) *Übertragung der Abrechnungsdaten (1/5.)* [online] Techniker Krankenkasse. Available at: https://www.tk.de/techniker/unternehmensseiten/elektronische-gesundheitsakte/uebertragung-abrechnungsdaten-2028836

56 *Gesetz für sichere digitale Kommunikation und Anwendungen im Gesundheitswesen (E-Health-Gesetz) 2015.*

for certification by gematik.[57] eMedication plans are not to be confused with an ePrescription service. Although gematik published the specifications required for ePrescription services in 2006 and 2008, there seems little hope that ePrescriptions will be introduced into the German system anytime soon. [58]

To date, telemedicine services have been offered only locally or in the context of selective contracts. However, at the German Medical Association's 2018 annual meeting, the long-running debate regarding the ban on offering remote treatment exclusively was brought to an end. Physicians can now, in accordance with their professional codex, provide treatment via telemedicine exclusively, as long as it is medically justifiable, and the requisite medical diligence can be ensured.[59] Presumably, most state medical associations (Landesärztekammer) will adopt this regulation, though there is the risk of a patchwork system emerging as individual associations could reject it. Video consultations are an aspect of telemedicine that involve physicians consulting remotely with each other over items such as x-rays and CT scans. These kinds of consultations that take place via digital technology have been billable since April of 2017. However, billing requires that the patient has given their written consent in advance.[60]

Planning for a publicly financed central portal for quality-assured health information – Germany's so-called citizens' portal – is still underway. The goal is to have the portal serve as a single point of contact linking all public services. However, individual measures targeting this objective have yet to be specified.

As in the case of telemedicine services, there is no uniform national framework for the field of mHealth. Instead, mHealth in Germany will be fostered by health insurance funds with selective contracts for specific groups of insured individuals.

Data integration and exchange readiness

gematik's efforts to foster interoperability in digital health are based on the interoperability registry provided by vesta. Service providers and product manufacturers that voluntarily commit to complying with standards will receive support from gematik in implementing such standards. However, telematics applications can receive support from the statutory health insurance funds' individual budgets only if they have been certified by gematik. Although the German Institute for Medical Documentation and Information (DIMDI) – an authority within the Ministry of Health – ensures the publication of official medical classifications, to date, there has been no attempt to target semantic interoperability by using reference terminologies and uniform terminology standards. In addition, there is no framework for a national medical terminology server or service. Indeed, Germany has yet

57 gematik (2018). *gematik-Brief.* [pdf] Berlin: Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH. Available at: https://www.gematik.de/presse/publikationen/.

58 gematik (2006). D*ie Spezifikationen der elektronischen Gesundheitskarte.* [pdf] Berlin: Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH. Available at: http://www.dkgev.de/pdf/1200.pdf.

59 Bundesärztekammer (2018). *Beschlussprotokoll des 121. Deutsche Ärztetages.* [pdf] Erfurt. Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=2ahUKEwjyrOrltercAhXI_KQKHb_UAXEQFjABegQICRAC&url=https percent3A percent2F percent2Fwww.bundesaerztekammer.de percent2Ffileadmin percent2Fuser_upload percent2Fdownloads percent2Fpdf-Ordner percent2F121.DAET percent2F121_Beschlussprotokoll.pdf&usg=AOvVaw2D5r02NoeEt48_E8fI1fo0.

60 Bewertungsausschuss (2016). *Beschluss des Bewertungsausschusses nach § 87 Abs. 1 Satz 1 SGB V in seiner 386. Sitzung am 12. Dezember 2016 zur Änderung des Einheitlichen Bewertungsmaßstabes (EBM) 2016.*

TABLE 8: **Digitalization profile Germany**

						Policy activity and strategy
						Digital health strategies
		■			P1	Digital health is an integral part of general health policy
	■				P2	Political will to support data transfer and data exchange is advanced
			■		P3	An effective strategy to digitalise the healthcare system is in place
			■		P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
		■			P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
			■		P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
				■	P7	A national digital health entity has been established for oversight of digital health implementation
			■		P8	Digital health service refunding and financing is in place on the national / regional level
			■		P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
		■			P10	Legal frameworks in place to protect sharing of patient data
		■			P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
			■		T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
■					T2	Sufficient security actions are in place to secure patient privacy
			■		T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
			■		T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
				■	T5	EPrescription services are operational
			■		T6	Telehealth and telemedicine can be routinely used
				■	T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
			■		T8	Patient control of content and access to the EHR
				■	T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
			■		T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
				■	T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
				■	T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
		■			T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
			■		A1	Digital health applications are a dominant solution for direct patient care
				■	A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
				■	A3	Level of EHR uptake is high
				■	A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
				■	A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
		■			A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
				■	A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply
Source: Bertelsmann Stiftung

to join as a member of SNOMED International, which owns and maintains the most commonly recommended standard for medical terms in Europe, SNOMED CT.[61]

Pilots and projects for the cross-border exchange of patient data are promoted and co-designed by gematik within the broader framework of EU eHealth initiatives.

3.2.5 Actual use of data

The German healthcare system features electronic documentation across all sectors. However, there is no national framework underpinning the exchange of data; instead, this takes place mostly through separate and individual networks (e. g., KV's Safenet). Electronic records and their content remain for the most part stored within a specific institution and are not shared with third parties.

Health insurance providers are the key drivers behind the secondary use of patient data for processes like billing invoices. In addition, routine data are used occasionally and, so far, somewhat randomly for the purpose of monitoring public health or healthcare research.

Patients inform themselves of health-related matters primarily through private providers (e. g., netdoktor.de) or they take advantage of offerings made available by the health insurance funds. The only central public healthcare information portal available in German is a product of the Austrian government (gesundheit.gv.at).[62]

61 EU H2020 Assess CT Project (2017). *ASSESS CT Recommendations.* [pdf] Assess CT. Assessing SNOMED CT for Large Scale eHealth Deployments in the EU. Available at: http://assess-ct.eu/fileadmin/assess_ct/final_brochure/assessct_final_brochure.pdf.

62 Bertelsmann Stiftung (2018). *SPOTLIGHT Health. Health Information.* Nr. 2, Gütersloh.


Australia
24.59 million inhabitants
7,692,024 km² area
3.2 inhabitants per km²
Digital Health Index
Score: 57.3
Rank 11

3.3 Australia

3.3.1 The national healthcare system

Service provision

In Australia, healthcare is guaranteed by a public health service (Medicare), which is available to the entire population. Responsibility is divided between the federal government and the states and territories. The federal government directs this with its framework planning and the agreements it comes to with the states and territories.

Private health insurance in Australia largely serves as an additional form of insurance in order to plug gaps in the public catalogue of services or between the costs actually incurred and those borne by Medicare. Contribution differences in a region exist only in relation to age. The Medicare system is based on the principle of benefits-in-kind and provides free hospital treatment or outpatient specialist treatment in public hospitals; in private hospitals, only 75 percent of fees are reimbursed by Medicare. The principle of cost reimbursement applies here. The Pharmaceutical Benefits Scheme (PBS) governs the supply of pharmaceuticals as part of the scope of the public health service. The scheme caps the amounts patients pay for pharmaceuticals in order to protect patients from being financially overburdened.

Financing

The healthcare sector is financed as follows: the government funds 43 percent through taxation (the Medicare levy[63]), and covers a majority of outpatient medical care, some of the private health insurance contributions, and pharmaceutical expenses. The states and territories are responsible for organizing and funding of hospital care, which comprises around 26 percent of total healthcare sector expenses. Private health insurance and private households fund the remaining 31 percent of annual healthcare expenses. Total expenditure on healthcare is equivalent to 9.3 percent of GDP.

Care provision

Australians can choose their general practitioner freely. The majority of general practitioners working in their own practice act as a gatekeeper: the costs of specialist outpatient care are borne by Medicare only if a referral is made by a general practitioner. In inpatient care, around a third of all hospital beds are provided by public institutions, and around two-thirds by private institutions. Patients have freedom of choice between public and private hospitals, although the latter commonly specialize in surgical and highly technical services. With 3.88 hospital beds per 1,000 inhabitants, Australia has somewhat less beds than the OECD average (4.7 beds). In addition, there are three physicians and 0.53 dentists per 1,000 inhabitants.[64]

63 The Medicare levy is an earmarked income tax surcharge calculated at a rate of 2 percent of an individual's taxable income.

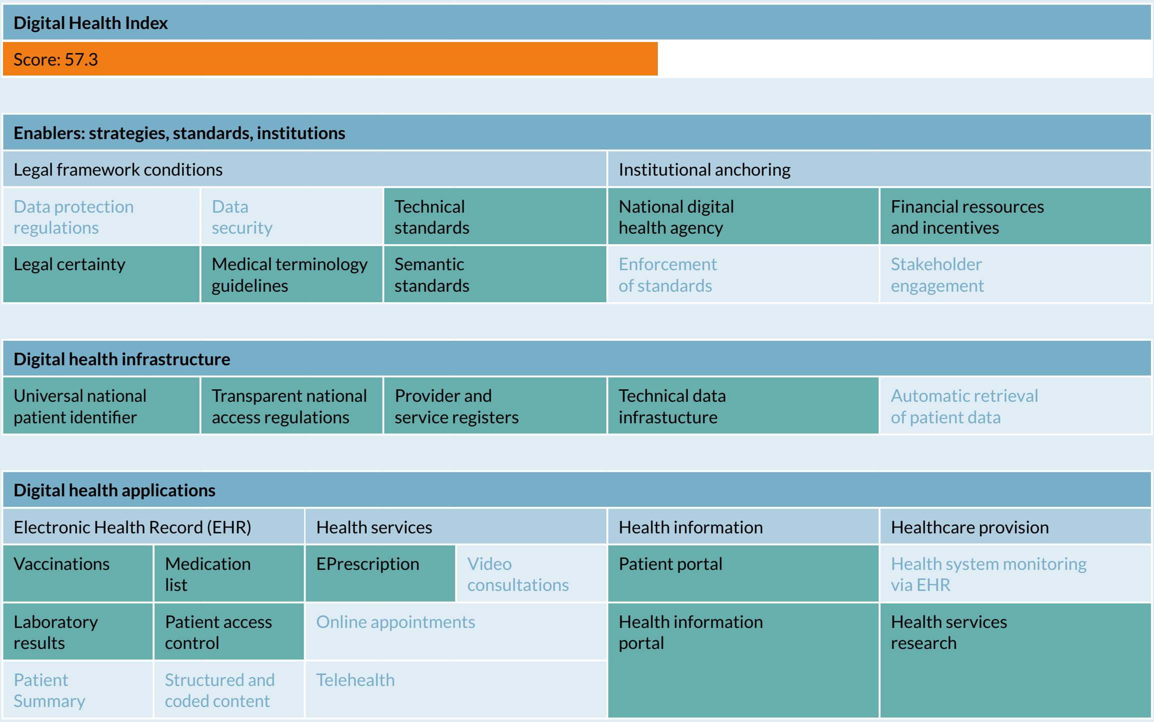
64 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

3.3.2 Development of digital health

In 1998, the first steps toward a national digital health policy were taken with the founding of the National Health Information Management Advisory Council (NHIMAC). Together with the federal and state/territory governments, and the relevant providers of healthcare, the council conceived a masterplan for digital health: Health Online. In July 2000, this taskforce presented the HealthConnect project. The project was supported with AUD 128.3 million for the development of a secure national health information network. However, none of the substantive concepts were developed beyond the theoretical work and test phase. Neither the electronic medication record nor the ePrescription systems outlined in the digital health strategy were seriously pursued after the pilot phase due a lack of political interest at the beginning of the 2000s.

In 2005, the Australian government and the Department of Health and Ageing (DoHA) founded National E-Health Transition Authority Limited, thereby introducing a formal process to identify and develop the necessary foundations of a national digital health infrastructure. Commissioned by the government, the professional services firm Deloitte presented an accompanying framework for coordination and cooperation in the field of digital health in 2008: Australia's first seriously pursued national digital health strategy. Based on the suggestion of the National Health and Hospital Reform Commission (NHHRC) to introduce an electronic health record (EHR) by 2012, DoHA made AUD 467 million available for use. In 2012, it was legally implemented as the My Health Record (MHR), and has been changed and expanded many times since. The record is based on uniform standards such as SNOMED CT-AU and Secure Message Delivery (SMD). By 2013, DoHA had made a further

FIGURE 10: **Map of digital health in Australia**



available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

AUD 200 million available for such purposes as supporting outpatient physicians in introducing the MHR in their practices. Since 2016, the Australian Digital Health Agency has assumed responsibility for the tasks of the National E-Health Transition Authority Limited and the Department of Health.

Figure 10 summarizes the existing digital health components identified in Australia as part of this study (green-shaded fields).

3.3.3 Policy activity and strategy

Digital health strategies

An effective digital health strategy has been drafted in Australia for all states and territories, which, in turn, coordinate their respective health policies through the advisory council of the Australian Minister for Health. All strategy-related activities take place at the regional level, and pertain to quality improvements in care, standardized data exchange between healthcare providers, and access to digital information for patients.

For more than 20 years, digital health in general has been pursued and implemented through national efforts, and not least by individual stakeholders and parties within the Australian government. Rather than being driven by technological development, implementation and planning have been the result of long political processes and negotiations in the federal system.

Through the digital health strategy, implementation programs for ePrescriptions, mHealth, and an (improved) EHR have been re-launched, and existing efforts relating to health information portals have been expanded. Australia would seem predestined for telemedicine, especially for the provision of outpatient care in the remote interior of Australia, the Outback. Due to an inadequate infrastructure policy (the development of the national broadband network has been greatly delayed, and is insufficiently specified), as well as a fee-for-service driven business model, the country does not yet possess such telemedicine.[65]

Despite the strategic importance of digital health and the willingness to introduce it in many areas of the healthcare sector, barely any legally binding material has been stipulated. As such, binding implementation plans have not been defined either. The private sector has been largely excluded from the process of developing and introducing digital health applications. In many cases, discussions take place through the Medical Software Industry Association and the Australian Information Industry Association in order to design the technical and content specifications of individual software applications.

Institutional anchoring, financing and legal framework

From 2016 to 2017, some AUD 153 million was available to the Australian Digital Health Agency for implementing the contents of the National Digital Health Strategy.[66] Both this agency and its predecessor have developed and published guidelines and implementation guides for clinical semantics and technical standards in order to allow producers to design

65 Sources: national correspondent and survey results.
66 Australian Digital Health Agency, (2017). *Annual Report 2016-17*. Sydney.

their products so that they are interoperable and can be interconnected with the digital health infrastructure. Major communication campaigns have been launched, such as for the MHR, and legal text has been co-developed. The Australian Commission on Safety and Quality in Healthcare is responsible for the ongoing evaluation of influences from digital health services and applications.

Financial support for physicians in general practice is made available by means of the *Practice Incentives Program,* so that they can conduct such measures as introducing new digital health applications or technologies into their practice. This funding comes from a private organization – there are no public funding programs or implementation incentives. In the field of research and innovation, the Medical Research Future Fund has been established, which is provided with around AUD 1 billion of government direct investment annually.[67] This doubles government expenditure on research and innovation for the period from 2016 to 2021.

The legal framework for exchanging patient data between various organizations is regulated by special laws, and thus extends the general data protection law. The legislator has precisely defined medical liability[68] with respect to medical errors and how medical products and EHRs are to be managed. However, the manner in which health-related data are to be processed, saved, or transferred has not been regulated. Patients also have no legal right to view their digitally saved health data if they so desire.

Although these data may be used for research, they may not be used for statistical evaluation by third parties. Even through digital health has played a major role in Australia for more than 20 years, only few educational institutions have begun to include it in their curricula or introduce training for working professionals.

3.3.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Nationally binding laws on the correct authentication of physicians have applied since 2010. A corresponding application checks access to digital health applications by medical professionals and identified patients. The MHR was legally introduced as early as 2012, has been used throughout the country for a number of years. Key data of the MHR are documented as patient summaries. Disease-specific patient summaries for cancer and diabetes are currently being piloted for national rollout.

Data security provisions and de-identification rules have to be complied with when exchanging data from EHRs. However, there is no monitoring and control body that regulates the various providers of EHRs. There are also commercial products to train practice and hospital staff in managing the new digital health applications. Most of the digital health technologies are based on an international standard for medical informatics, but there is neither a legal obligation to use a single standard, nor is there a unified coding standard throughout the entire digital health network.[69]

67 Australian Medical Research Advisory Board, (2016). *Australian Medical Research and Innovation Strategy 2016–2021.*

68 These can include: misdiagnoses, treatment errors, documentation errors, insufficiently informing patients, and mistakes relating to the division of labor between different physicians.

69 Sources: national correspondent and survey results.

Digital health applications and services

Physicians in Australia no longer need to issue prescriptions in paper form; using software, they can now be directly transferred as an ePrescription by the physician and accessed and dispensed in any selected pharmacy. The confirmation that medication was successfully dispensed to a patient can also be electronically transmitted. Telemedical services have thus far only been applied sporadically in local projects, and there is still no reimbursement system with Medicare for them.

The health information portal Healthdirect is a first point of call in the internet for diseaserelated questions or to find the closest specialist in a city. While this publically funded portal offers non-personalized health information and contributes to greater patient empowerment, there are also a number of other portals that offer access to the MHR or the ePrescription service. The states of Queensland and Victoria do not support Healthdirect and offer their own portals.

The MHR represents protected documentation of a patient's medical history. The patient is free to choose which documents and information are stored in the system, and which physicians have access to it. The patient can also delete content and documents and select which documents may be transferred by their physician to other physicians. Practice reports, discharge papers, prescriptions, invoices, and vaccination data are stored in the MHR.

Of particular note in Australia is the attempt to successfully establish a broadscale national EHR by applying strict opt-out rules for the MHR: under the leadership of the Australian Minster for Health, Greg Hunt, the Department of Health will automatically provide an MHR for every citizen by the end of the year, so long as their consent is not actively withdrawn within a three-month opt-out period.[70] As an opt-out system, it does not replace the medical records created by physicians and other healthcare providers, but rather constitutes a useful summary of all relevant medical information and guarantees their secure exchange.

Part of the MHR is a patient summary known as the Shared Health Summary. National rollout began in July 2018. The success of the Shared Health Summary will be largely determined by its acceptance by outpatient physicians, who need to maintain the document after patient visits. The Shared Health Summary comprises a summary of the patient's health condition, medication, allergies, vaccinations, as well as personal information such as age and sex at a particular point in time, such as their last visit to the physician. These data are automatically saved in the MHR by means of a data network. The most current Shared Health Summary is usually the first document in the MHR that is viewed by other medical professionals.

With respect to mHealth, there is no clearly defined delineation of tasks and supervisory competencies between the existing authorities in the healthcare sector. Since July 2018, the first MHR data has been able to be viewed using mobile devices. Initially, this function has been limited to X-ray images, but will be gradually expanded in future. However, coordination of the care of chronic patients is not possible using the MHR, as the necessary level of detail is not present. In this case, physicians often still engage in bilateral discussions, or use other means of electronic communication.

70 Powles, J. (2018). *There is no social licence for My Health Record. Australians should reject it.* [online] The Guardian. Available at: https://www.theguardian.com/commentisfree/2018/jul/20/there-is-no-social-license-for-my-health-record-australians-should-reject-it?mc_cid=63ff9e7acc&mc_eid=3602cf366e.

Data integration and exchange readiness

Although common standards have been developed and published by the Digital Health Agency, it cannot introduce any legally binding measures. In consequence, though there are officially many documents and resources that would enable an interoperable, standardized Australian health information network, their implementation has been patchy. Less than 25 percent of all healthcare providers use the same guidelines for clinical terminology that are used for the MHR, although such guidelines are available.[71] Due to a lack of standardization and interoperability, only few digital health applications can communicate with each other and exchange data, in order to (statistically) report on the quality, access to, and efficiency of the healthcare system. Cross-border data exchange in transnational data systems has thus far only been outlined as an objective in the National Digital Health Strategy and has not yet taken place.

3.3.5 Actual use of data

Over three-quarters of general practitioners in Australia record clinical and medical data electronically, and are interconnected with a national health information network (e. g., an EHR). Only 60 percent of specialists are computerized and connected. This figure is comparatively lower in hospitals, at around 50 percent to 75 percent. In outpatient care, more than 75 percent of providers are connected to the national ePrescription service, and prescriptions are issued almost exclusively electronically. In inpatient care, the MHR is used by only around 25 percent to 50 percent of all public institutions.[72] The following additional information systems are connected to the MHR and allow data exchange:

- laboratory information systems
- pathology information systems
- pharmacy information systems
- image archiving and communication systems (only reports, no images)
- automatic vaccination reminder systems

Although a majority of providers possess access to a health information network, less than 25 percent of physicians in practices and hospitals exchange data with another.

Saved information from acute care is not used for public medical research. The data from the MHR is and may only be used for publicly funded research projects in accordance with strict data protection requirements, and only with the patient's consent. These data may also be used for general health system monitoring, and for quality assessments.

The automatic transfer of data from the MHR into other national health data registries takes place only for ePrescriptions. All other data have to be actively transferred or created by the treating physician. Less than 25 percent of the clinical documentation in the MHR is based on common terminological standards and classifications, as there is no national obligation to adhere to such standards, nor is the quality of the contents of these documents subject to review by random sampling. In 2017, on average, less than 25 percent of the public and patients visited health information portals.[73]

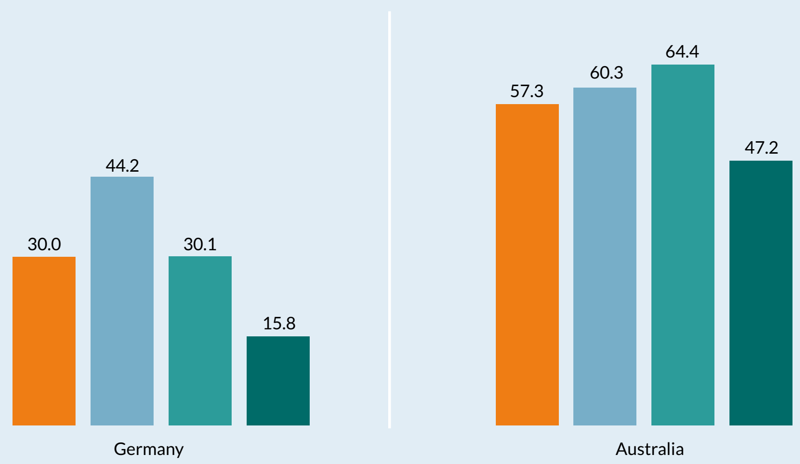
71 Sources: national correspondent and survey results.
72 Sources: national correspondent and survey results.
73 Sources: national correspondent and survey results.

3.3.6 Digital Health Index: Comparison with Germany

As described in the methods section, in comparing international digital health development, the results of the individual countries are juxtaposed with the results from Germany. Figure 11 presents the relative points of the Digital Health Index and the three sub-indices in a bar chart.

In figure 11, it can be readily seen that Australia has more points than Germany not only in the Digital Health Index, but also in all three sub-indices. Of particular note is that the ratings of sub-indices are significantly more balanced, highlighting that Australia is already at another stage of development with respect to digital health, with digital health readiness and actual data usage keeping pace with policy activity.

FIGURE 11: **Comparison between Germany and Australia,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity Digital Health Readiness Actual use
Source: Bertelsmann Stiftung

TABLE 9: **Digitalization profile Australia**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
■					P2	Political will to support data transfer and data exchange is advanced
	■				P3	An effective strategy to digitalise the healthcare system is in place
			■		P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
				■	P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
		■			P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
■					P7	A national digital health entity has been established for oversight of digital health implementation
	■				P8	Digital health service refunding and financing is in place on the national / regional level
			■		P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
		■			P10	Legal frameworks in place to protect sharing of patient data
			■		P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
			■		P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
	■				T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
■					T2	Sufficient security actions are in place to secure patient privacy
		■			T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
■					T5	EPrescription services are operational
			■		T6	Telehealth and telemedicine can be routinely used
		■			T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
■					T8	Patient control of content and access to the EHR
				■	T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
■					T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
		■			T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
			■		T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
			■		T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
		■			A1	Digital health applications are a dominant solution for direct patient care
■					A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
			■		A3	Level of EHR uptake is high
				■	A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
		■			A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
■					A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
			■		A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung


Belgium
11.37 million inhabitants
30,528 km² area
372.1 inhabitants per km²
Digital Health Index
Score: 54.7
Rank 13

3.4 Belgium

3.4.1 The national healthcare system

Service provision

Belgium's welfare state is based on the principle of social security, which is why the provision of healthcare is dominated by contribution-funded social health insurance. As part of this, compulsory health insurance effectively applies to almost the entire population. As the catalogue of services and the contribution amounts of the various health insurance funds are determined by the central government, competition is limited to the field of supplementary health insurance. Although Belgium is characterized by federalism, the requisite competencies lie with the central government. The implementing body is the National Institute for Health and Disability Insurance (NIHDI), which is subordinate to the Federal Minister of Social Affairs and Health. NIHDI is responsible for the organization and financial management of statutory health insurance. Private insurance is also offered by the statutory health insurance funds, but there are also a number of private health insurance funds that are essentially limited to the role of providing additional and supplementary health insurance.

Financing

Similar to the German system, funding is provided by the government, insurance policyholders, and employers by means of a global contribution. The government plugs most of the deficit between the revenues from contributions and expenditure with various subsidies from tax revenues. In 2015, the government funded the healthcare system with the equivalent of 10.4 percent of GDP. However, a large part of healthcare costs were covered by co-payments.

Care provision

The general practitioner does not act as a gatekeeper, and the patient may also visit a specialist directly, or go straight into outpatient specialist care, which is usually provided in hospitals. Around 70 percent of Belgian hospitals are under private, not-for-profit ownership. In 2011, there were 6.2 hospital beds per 1,000 inhabitants – higher than the OECD average of 4.7.[74]

3.4.2 Development of digital health

In the past, the nature of Belgium's federal system resulted in the regular launch and implementation of smaller projects in the field of digital health. National projects entered the picture only in the beginning of the 2000s with the introduction of Kind Messages for the Electronic Healthcare Record (KMHER), a Belgian HL7-based implementation standard, with which structured clinical information could be exchanged.

74 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

In 2004, an electronic ID was introduced, the eID. The eID comes from the Federal Public Service Information and Communication Technology, and can be used by patients and physicians for authentication purposes in the internet. As the trend of storing data electronically had made inroads in Belgium as early as the beginning of the 2000s, it was a challenge to retrospectively connect the various systems with each other so that data could also be available nationwide. In 2004, the decision was made to develop the Belgian platform Be Health, which was tasked with identifying, developing and implementing a digital health vision, as well as the necessary standards, infrastructures and strategies. The objective was to enable the national exchange of data using an exchange platform.

In 2008, the eHealth-platform agency took over this task. However, the centralistic approach was soon abandoned in order to get around data protection problems and the integration issues of the individual systems. In accordance with Belgium's federal structure, regional data hubs arose over time that store personalized patient data, though these data are located and referenced via technical request using a metahub. Outpatient and inpatient care are integrated in the system using five of these data hubs connected to the metahub. So that this information can be accessed, important requirements have to be fulfilled to prevent data misuse. The introduction of other service providers, such as dentists and rehabilitation and long-term care facilities, is currently in planning.

Certified electronic health records (EHRs) have existed in Belgium since 2002, but a common national standard did not exist until the introduction of the Summarised Electronic Healthcare Record (SumEHR). Since then, all individual systems have to be able to provide

FIGURE 12: **Map of digital health in Belgium**

Digital Health Index
Score: 54.7

Enablers: strategies, standards, institutions				
Legal framework conditions			Institutional anchoring	
Data protection regulations	Data security	Technical standards	National digital health agency	Financial ressources and incentives
Legal certainty	Medical terminology guidelines	Semantic standards	Enforcement of standards	Stakeholder engagement

Digital health infrastructure				
Universal national patient identifier	Transparent national access regulations	Provider and service registers	Technical data infrastructure	Automatic retrieval of patient data

Digital health applications					
Electronic Health Record (EHR)		Health services		Health information	Healthcare provision
Vaccinations	Medication list	EPrescription	Video consultations	Patient portal	Health system monitoring via EHR
Laboratory results	Patient access control	Online appointments		Health information portal	Health services research
Patient Summary	Structured and coded content	Telehealth			

■ available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

a framework of patient data to the SumEHR.[75] The necessary standards were defined by the eHealth-platform, and all data are merged in one centralized location. The SumEHR does not in any way replace the patient records maintained by physicians, but rather constitutes a summary of the patient's medical information that is available to both the patient and the physician, so that additional physicians, caregivers, and other service providers can administer the optimal treatment in case of emergency. The SumEHR contains general and contact information, patients' risk factors, their medical history, current treatments, prescriptions, and vaccination data.

Figure 12 summarizes the existing digital health components identified in Belgium as part of this study (green-shaded fields).

3.4.3 Policy activity and strategy

Digital health strategies

Belgium's current digital health strategy, Actieplan eGezondheid 2015-2018, was originally published as early as 2013, and had to be updated in 2015. The strategy contains 20 specific work packages, some of which are scheduled for completion in 2019. The main objective of the strategy is to grant greater decision-making competency and empowerment to patients by means of a variety of integrated digital services (see chapter 3.4.4.). This is also intended to improve access to services and quality of care in general.

Following its initial release in 2013, the first gaps in the strategy (due to the rapid development of mHealth) were identified at the ministerial level, and an updated version was released in cooperation with the eight regional health ministries. In conceptual terms, the strategy is focused more on the consumer than on technical issues, following the motto "many services, one system." Although big data and telemedicine are not mentioned, an EHR, an ePrescription service, mHealth applications, and a health information portal are planned, and legally binding implementation plans are provided. The action plan is an extensive, all-round strategy that includes technical and semantic standardization requirements for the new applications.

All stakeholder groups are involved in the development and design of the new digital health applications: the medical profession, the public, and private companies. There are no plans to directly stipulate potential improvements to services that could be achieved through the 20 work packages.

Institutional anchoring, financing and legal framework

The implementation of the strategy will be made possible by a corresponding budget, and the appropriate institutions will be established for the determination, monitoring, and implementation of interoperability standards and mHealth applications. The eHealth-platform agency and the Belgian Health Telematics Commission (BHTC) are responsible for implementation and evaluation, as well as for the development of all necessary technical and semantic requirements for the digital health applications stipulated in the strategy.

75 Sources: national correspondent and survey results.

The NIHDI insurance institution is working together with the eHealth-platform on the implementation of the action plan and has developed the relevant financial plans that allow the regular billing and reimbursement of digital health services by insurance companies. As it is subordinate to the Federal Minister of Social Affairs and Health, it receives public funds that are used to reimburse these services.

The final implementation of the applications from the various work packages will be supported with public funds. Providers may incur financial penalties if the implementation schedule is not adhered to. These can also be used by publicly supported training programs.

There is no legal framework for the storage and exchange of health data beyond organizational boundaries, nor is there one for medical liability with respect to medical errors in the context of medical products and EHRs.[76] However, explicit laws were introduced regarding the handling of data in the SumEHR, standardized data exchange procedures, and patients' access to their own health data.[77] Third parties may continue to use digitally stored health data for statistical and research purposes, so long as this usage is in compliance with the general data protection provisions on security, format, archiving, transfer, and access. In general, few educational institutions offer courses or training for dealing with digital applications.

3.4.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

The eID is available to the entire population, and serves as a means of identification not only when visiting the physician, but also with all public authorities, and grants access to public online services. The equivalent ID for physicians ensures that only the treating physician has access to a patient's digitally stored data.

Across the country, health data have to be de-identified as soon as they are digitally transferred in any form and can only be re-identified through the active process of accessing a particular individual's data. This process occurs automatically through the five regional data hubs.

The Belgian health data network is based on international standards that are binding in Belgium. However, a separate standard (KMEHR) was developed specifically for the coded exchange of clinical data from the SumEHR.[78] In addition, the eHealth-platform, run by the Belgian government, lists all recommended and prescribed standards, and offers them as downloads as well.

76 These can include: misdiagnoses, treatment errors, documentation errors, insufficiently informing patients, and mistakes relating to the division of labor between different physicians.

77 See also: Rijksarchief in België, (2016). *Digital Act: België zet een belangrijke stap vooruit op vlak van elektronische archivering.* [online] Available at: http://arch.arch.be/index.php?l=nl&m=nieuws&r=alle-nieuwsberichten&a=2016-10-27-digital-act-belgie-zet-een-belangrijke-stap-vooruit-op-vlak-van-elektronische-archivering.

78 eHealth Belgium, (2018). *eHealth Platform Standards.* [online] Verfügbar: https://www.ehealth.fgov.be/standards/kmehr/en.

The SumEHR is not an EHR in the strict sense, but rather constitutes a concise summary with relevant emergency medical data. A comprehensive EHR is not available at the national level and is generally prevalent only among a small amount of outpatient physicians.[79]

MyCareNet is an online platform that facilitates communication between healthcare providers and health insurance funds. The exchange of information, such as of prescriptions, is automated, and simplifies the bureaucratic processes many times over. The portal is a joint initiative of the Nationaal intermutualistisch college (NIC), the eHealth-platform health information portal, and NIHDI.[80]

Digital health applications and services

Since 2013, the national ePrescription service has enabled the electronic transfer of prescriptions to pharmacies and the dispensing of medication to patients. Telemedical services are used only occasionally by a small number of hospitals to allow the remote monitoring of critically ill patients. Apart from this, they are not used in routine care.

By law, physicians may not base their treatments on remote diagnostics alone. Health information portals rarely contain patient-oriented services (e.g., access to an EHR/medication plans), and are offered only regionally by private organizations. Although patients are permitted to view data stored in electronic records, very few actually have the possibility to do so.

This kind of EHR, known as the Globaal Medisch Dossier (GMD), is provided by private companies or, if the patient's general practitioner offers it, by the national insurance institution. The GMD is an EHR limited to one physician that can be transferred as required to a new general practitioner or specialist. However, new data always have to be transferred from other physicians to the physician responsible for the GMD (usually the patient's general practitioner), who then has to manually insert these new data into the GMD. The prevalence of this EHR is still limited, despite the fact that patients are granted financial benefits for the medical services they use if they open a GMD.

Since 6 February 2018, outpatient physicians have been able to electronically transfer medical certificates and attestations to support patients' health insurance funds. This has been made possible by the eAttestation service of the MyCareNet platform. This will, in the longterm, make paper attestations and medical certificates redundant.[81]

Patients are not able to alter the information in the GMD but can decide on which physicians have access to the record. mHealth is one of the new action items of the Belgian digital health strategy, however there is still no supervisory authority for the many new pilot projects in this field. There are no clear guidelines for mHealth startups, and only few of the new apps are able to interconnect with an electronic record.

79 Van de Voorde, C., Van den Heede, K., Obyn, C., Quentin, W., Geissler. A., Wittenbecher, F., Busse, R., Magnussen, J., Camaly, O., Devriese, S., Gerkens, S., Misplon, S., Neyt, M., and Mertens, R. (2014). Conceptual framework for the reform of the Belgian hospital payment system. *KCE Reports* [online] 2014, 229, p. 92.

80 riziv.fgov.be, (2017). *MyCareNet: een centraal dienstenplatform op het web.* [online] Available at: http://www.riziv.fgov.be/nl/themas/zorgkwaliteit/e-gezondheid/Paginas/MyCareNet.aspx#.WthYrX8uCyp.

81 RIZIV, (2018). *Elektronisch attesteren met eAttest.* [online] Available at: http://www.inami.fgov.be/nl/professionals/individuelezorgverleners/artsen/beroep/Paginas/elektronisch-attestern-eattest.aspx#.Wthaf38uCyp.

Data integration and exchange readiness

With the binding introduction of the KMEHR by the BHTC in 2002, data can be exchanged between the individual regional hubs. This allows data from various local systems to be stored in the data hubs. However, clinical terminologies are used inconsistently by the various providers. One of the recommended standards is LOINC, which defines the linking of test results with codes. These unique codes allow data to be exchanged in a common language.[82] However, less than 25 percent of Belgian physicians adhere to the recommended classifications. For the majority of health datasets, the reverse is true: between 50 and 75 percent of the datasets that are stored regionally or nationally are designed in such a way that they follow the same guidelines. Nevertheless, less than 25 percent of them are technically capable of communicating with each other.[83]

The lack of interoperable datasets and registries rules out their usage for the purposes of general healthcare system monitoring. In addition, it is estimated that only a fraction of the Belgian population is recorded in these datasets and registries. At the moment, Belgium is taking part in various transnational data exchange projects in the field of healthcare. However, there are no plans for the automatic transfer of heath data into transnational data networks, nor are there plans to develop a corresponding strategic roadmap for this.

3.4.5 Actual use of data

In general, the proportion of physicians that use electronic practice systems in outpatient care is quite high, at 75 percent. In inpatient care, only 50 to 75 percent of all physicians record data electronically. In Belgium, pharmacies and over 75 percent of physicians from all healthcare sectors are connected to a health data network, but less than 25 percent of physicians are technically able to exchange data with pharmacies. Around 50 to 75 percent of all prescriptions issued are ePrescriptions.[84]

A national EHR system has not been introduced. Nevertheless, it should be taken into account that, in contrast to the various privately offered EHR systems, the SumEHR can be used in all Belgian hospitals, and is very often employed in communication between physicians and specialists. More than 75 percent of all outpatient physicians exchange patient-related health information with each other and specialists. The number of physicians who exchange information with hospitals is similarly high.

Information from neither the SumEHR nor the GMD may be used for statistical or research purposes. Individual disease-specific data registries (e.g., for cancer or diabetes) are used by the Federal Public Service Health, Food Chain Safety and Environment in order to obtain information on the quality and efficiency of healthcare provision in specific areas. The SumEHR is automatically updated with the following individual datasets:

- information from outpatient care
- medication and prescription information
- cancer registry data
- diabetes registry data

82 health.belgium.be, (2016). *ReTam: LOINC.* [online] Available at: https://www.health.belgium.be/fr/terminologie-et-systemes-de-codes-loinc.
83 Sources: national correspondent and survey results.
84 Sources: national correspondent and survey results.

TABLE 10: **Digitalization profile Belgium**

						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
■					P2	Political will to support data transfer and data exchange is advanced
		■			P3	An effective strategy to digitalise the healthcare system is in place
		■			P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
		■			P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
		■			P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
	■				P7	A national digital health entity has been established for oversight of digital health implementation
	■				P8	Digital health service refunding and financing is in place on the national / regional level
■					P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
		■			P10	Legal frameworks in place to protect sharing of patient data
	■				P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
			■		P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
■					T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
■					T2	Sufficient security actions are in place to secure patient privacy
■					T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
		■			T5	EPrescription services are operational
				■	T6	Telehealth and telemedicine can be routinely used
			■		T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
				■	T8	Patient control of content and access to the EHR
				■	T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
	■				T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
			■		T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
			■		T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
			■		T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
		■			A1	Digital health applications are a dominant solution for direct patient care
			■		A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
				■	A3	Level of EHR uptake is high
	■				A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
				■	A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
	■				A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
			■		A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung

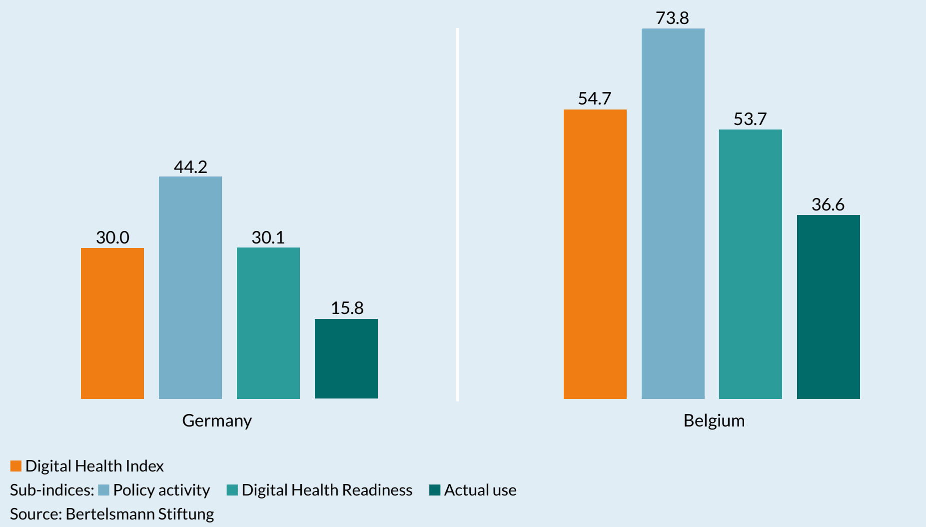
Less than 25 percent of the data created by physicians in digital records are based on common standards, nor are they quality controlled by a central authority. There are no training programs for a common terminology in healthcare.

In 2017, around 25 to 50 percent of the patients in Belgium visited health information portals to find out about various topics, and just as many have potential access to part of their own health information (usually through private providers; there are, as yet, no public providers). In general, these portals are used more by patients that were in inpatient treatment (50 to 75 percent) those with minor disorders (>25 percent).[85]

3.4.6 Digital Health Index: Comparison with Germany

The comparison between Belgium and Germany demonstrates the higher scores of Belgium, not only in the Digital Health Index, but also in all three sub-indices. It is also clear that the scores of the sub-indices have a similar relationship to each other as those in Germany but are simply higher overall.

FIGURE 13: **Comparison between Germany and Belgium,** in the Digital Health Index and sub-indices



Source: Bertelsmann Stiftung

85 Sources: national correspondent and survey results.


Denmark
5.75 million inhabitants
42,931 km² area
133.9 inhabitants per km²
Digital Health Index
Score: 72.5
Rank 3

3.5 Denmark

As Denmark belongs to the group of countries that are analyzed in more detail in Part II, this is an abridged version of the country report. This chapter is based on research and the results of the benchmarking survey, while the more in-depth analysis of Denmark is additionally based on study-related visits and additional local interviews, as described in the chapter addressing this study's methodology.

3.5.1 The national healthcare system

Service provision

Denmark organizes its healthcare through a public-health service that is available to the entire population and is performed at a regional or municipal level. Up to 2006, the central government and the Ministry of Health were only permitted to formulate the framework legislation, the objectives, and the recommendations, and to (co)fund the system. Counties and municipalities were responsible for establishing a catalogue of services, as well as organizing and ensuring the healthcare service. Municipalities and counties decreased in importance with the Municipal Reform of 2007, which merged municipalities, abolished the counties, and set up five regions that incorporate the newly merged municipalities. These lost the right to levy their own taxes, and decisions on the construction of hospitals were transferred to the central government. Because of the growing length of waiting lists in recent years, private health insurance funds are becoming increasingly important. These offer treatment in private hospitals where necessary.

Financing

The Danish healthcare sector is financed principally through taxes. Since 2008, an earmarked health tax amounting to 8.6 percent of taxable income (as in 2015) has been levied, with the municipalities receiving corresponding funds from the central government. In 2017, healthcare expenses were the equivalent of 10.4 percent of GDP making Denmark's healthcare system one of the top ten most expensive in Europe. The municipalities finance around 20 percent of total healthcare expenses in the regions. The payment consists of an activity-based contribution that depends on public usage of hospitals. The objective of the local contributions is to encourage the municipalities to introduce efficient preventative measures for the public in matters of health.

Care provision

For the majority of insurance policyholders, a kind of coverage is possible whereby the general practitioner fulfills the function of gatekeeper. Patients have to make a firm decision regarding their general practitioner, who can only be changed after six months. Of the outpatient physicians, around two-thirds work in group practices and are responsible for administering primary care. These physicians then refer their patients to specialists or hospitals when necessary. Most of the hospitals are owned by the regions and are accessible to the population across the country. With 5.5 hospital beds per 1,000 inhabitants, Denmark has high capacities relative to the OECD average of 4.7 beds.[86] Far-reaching

86 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

hospital reform is already enshrined in law, and its long-term implementation will start next year.

3.5.2 Development of digital health

With over 20 years of experience in the field of digital health, the Danish company MedCom has been responsible for the development and distribution of electronic means of communication in healthcare since 1994. It plays a central role in the intersectoral communication of individual health services. Another driving force is the National Board of eHealth, which has the objective of building national ICT infrastructure and continuously developing it. It also establishes the required standards for the interoperability of the various regional systems that are used in most physicians' practices and in many hospitals.

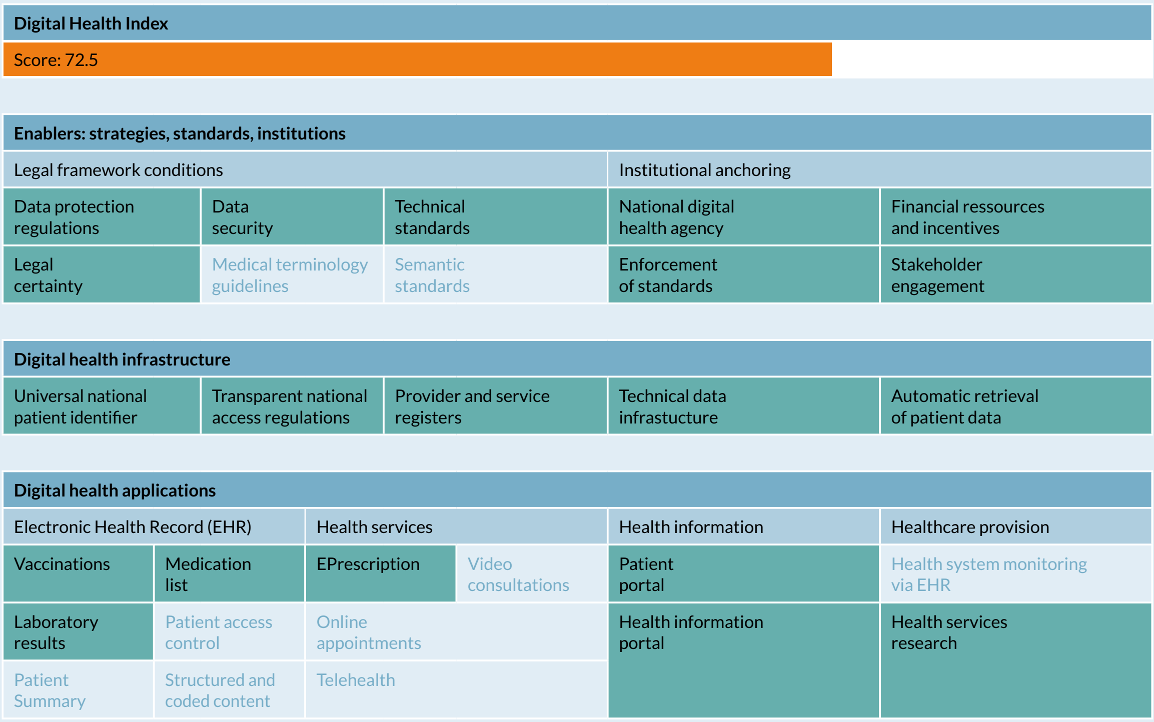
In 2010, the Danish Agency for Digitisation developed the NemID in cooperation with Nets DanID A/S. This is an online login solution for Danish banks, websites, and the general administration allowing regional / decentralized health applications to connect with national health services, registries, and report solutions (e.g., the Shared Medication Record). In 2011, the Danish government and the municipalities tasked the National Board of eHealth with making the organizational structure more cost-efficient and leaner. One of the primary goals was to channel all existing health information and make it nationally accessible where needed. As an example of its activities, the number of different active EHR systems in hospitals across the country was reduced from 27 in 2007 to four by 2013.

In principle, there are three larger digital services at the national level that are extensively used. The E-Journal is a central database that references data directly from the EHRs of the hospitals in Denmark's five regions. This provides medical staff with direct access to patients' hospital-based health records. In future, the E-Journal will be supplemented by the P-Journal, which will store information from the EHRs of outpatient physicians and tertiary healthcare institutions. Together, these databases will provide a comprehensive listing of patient-related information. Physicians and patients will be able to access this collection using the health information portal sundhed.dk.

As the hospitals rely mainly on regional or local systems that cannot always communicate with the EHRs in physicians' practices, a national medication database was implemented, the Shared Medication Record. This provides information on patients' current medication and their vaccination status. Previously issued prescriptions are stored for two years and can be accessed by all physicians and pharmacies in Denmark that the patient grants this access to. Physicians are legally obliged to keep this record up-to-date, and also have to ensure that all IT systems can access this database.

The final cornerstone of the Danish digital health system is the health information portal sundhed.dk. Since 2004, the Ministry of Health, the regions (in their capacity as major financial stakeholders), and the municipalities have run this portal, kept it up-to-date, and have used it to bring together the aforementioned databases. There are also a number of additional services, e.g. a national ePrescription server. This allows the electronic transfer of prescriptions as well as their cancellation by the treating physician. The treating physician receives an automatically generated message as soon as medication is dispensed to a patient. In addition, test results can be uploaded and viewed, and general information on treatments and diseases can be obtained. The portal also provides an overview of the Danish healthcare sector and is the central communication platform of the healthcare

FIGURE 14: **Map of digital health in Denmark**



■ available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

service. Following the 2009 relaunch of the portal on a new technical platform, its usage by the public increased in part by 45 percent. Taken together, these applications and information constitute a national health record.

Figure 14 summarizes the existing digital health components identified in Denmark as part of this study (green-shaded fields).

3.5.3 Policy activity and strategy

Digital health strategies

The Danish Digital Health Strategy is aligned with two further overarching framework plans:[87] the digitalization strategy of the Danish public sector (Digital Strategy 2016-2020[88]), and the Citizen and Patient Involvement Strategy.[89] Together, these form the

87 Danish Ministry of Health, Danish Ministry of Finance, Local Government Denmark, and Danish Regions, (2018). *A Coherent and Trustworthy Health Network for All: Digital-Health Strategy 2018-2022.* [pdf] Available at: https://www.sum.dk/~/media/Filer percent20- percent20Publikationer_i_pdf/English/2018/A-coherent-and-trustworthy-health-network-for-all-jan-2108/A-coherent-and-trustworthy-health-network-jan-2018.pdf.
88 Danish Government, Local Government Denmark, and Danish Regions, (2016). *A Stronger and More Secure Digital Denmark: Digital Strategy 2016-2020.* [pdf] Copenhagen: Agency for Digitalisation. Available at: https://digst.dk/media/16165/ds_singlepage_uk_web.pdf.
89 Styrelsen for Patientsikkerhed, (2017): *Citizen and Patient Involvement Strategy.* [pdf] Available at: https://stps.dk/en/publications/2017/citizen-and-patient-involvement-strategy/~/media/304D1E92CAFD4EC1ACC17A6755F2E282.ashx.

foundation for the far-reaching, comprehensive digitalization of Danish society, simplified access to various public services, as well as a cost-efficient, user-friendly and secure healthcare system. The national Digital Health Strategy, which has been formulated as a guideline for the healthcare sector, does not mention health IT directly. However, it does refer specifically to the national digitalization strategy, ensuring that these two strategies are very well coordinated with each other. This probably indicates that, from a Danish perspective, digitalization is a means rather than an end in itself.

There is certainly political will for digital reforms in the face of the changes in the healthcare system that can be felt across the world, as well as for accompanying these with the relevant data protection laws. For the most part, general implementation objectives are determined at a high political level without specifying a direction for technical details. Danish standardization organizations can influence national plans and the political activity at the local level without these decisions ever reaching the national level.

There are also strategic plans and initiatives for EHRs and telemedicine within the current national Digital Health Strategy, however there are none for ePrescriptions, as these services have already been fully implemented. mHealth is not accompanied by its own strategy either but is instead embedded in current strategies as a means to improve patient empowerment. Interoperability is also approached as a means to an end. The term “sammenhæng,” which is widely used in the strategic work, essentially means “connected/communicating healthcare sector” in this context. A prerequisite for this is interoperability – and some of the national institutions have the main task of developing interoperability solutions (MedCom and the Danish Health Data Authority) – but this is regarded as a means to an end, not an objective in itself.

Implementation framework plans are not prepared by the central government; this is the responsibility of the individual organizations tasked with the introduction of certain applications and services. However, binding timeframes have been stipulated within these plans for the introduction of the applications and services. The eHealth Board also stipulates implementation targets, and financial support is dependent on their fulfillment. There is stakeholder participation in many areas of development and implementation. The public (mostly in the form of test groups), the medical profession, and stakeholders from business work together with the authorities at various stages of implementation. However, they do not take part in cost-benefit analyses or the definition of exact performance targets of new technologies or services.

Institutional anchoring, financing and legal framework

Denmark has a national terminology center – SNOWMED CT as well as other terminologies have been stipulated as national standards. However, there is no national strategy for this area – some terminology guidelines and classification catalogues are binding, while others are not.

Mobile health applications are not directly part of the Danish Digital Health Strategy. The agenda for sundhed.dk in the coming years stipulates the task of clarifying whether,[90] and to what extent, patient portals should be integrated with mobile applications.

90 sundhed.dk is the Danish digital health portal. It provides access to Danish healthcare services as well as information on these services and on general health-related issues.

The Ministry of Health, the regions, and municipalities share the direction of the various authorities in the field of digital health. MedCom promotes cooperation between the authorities, organizations, and private companies that are connected to the Danish healthcare sector and develops standards for the exchange of health data throughout the entire Danish healthcare sector. Furthermore, it also monitors the national technical and organizational implementation of standards. The Danish Health Data Authority operates a range of technical services, monitors the use of digitally stored data, and makes these data available for research purposes. In addition, the Danish Data Protection Agency monitors the proper processing, storage, and usage of health data.

Each of the individual initiatives of the Digital Health Strategy has its own budget and is funded by the respective public authorities involved. The initiatives are typically prioritized and financed in economic policy negotiations between the central government, regions, and municipalities. Patients incur no additional costs when using digital services, as these are jointly financed by the central government and the health insurance institutions. Part of the government budget is used to facilitate the implementation of newly developed digital health applications in hospitals and medical practices.

There are no explicit laws regulating EHRs, as general legislation regarding processing personal data, the duties and liabilities of healthcare providers, and the legislation on patient rights cover patient records in both paper and digital form. There are regulations on data protection, especially for institutions that "possess" EHRs. This stems from the law on the processing of personal data. Healthcare providers are obliged to update the health record where necessary, and this occurs without the patient's consent. However, patient consent is required for the physician to access the record, and for sharing patient data. Laws restricting patients' access to their own data have been repealed. This is to ensure that patients can obtain the maximum benefits from new technological advances. With respect to liability, there are no regulations in Denmark on the handing and processing of electronic health data. This is covered by general liability law. Failure to comply with the data protection legislation may result in penal sanctions.[91]

The data saved in EHRs may also be used for secondary purposes, such as for research or quality controls, as long as these purposes do not conflict with the law on the processing of personal data or general health law. This does not require the clear consent of the patient.

Most universities offer general IT courses, including with respect to health IT, in order to train current and future professionals in new digital solutions. Some hospitals and other public institutions also offer similar training measures. There are no national standardized training programs in the field of change management, but these are offered at the regional and municipal level.

91 Hartlev, M. (2014). *Overview of the national laws on electronic health records in the EU Member States: National Report for Sweden.* Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_sweden_en.pdf.

3.5.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

The central access point for all public digital services is NemLog-in, which is integrated with sundhed.dk, among other services. This was developed in 2007, as part of a joint project involving counties, municipalities, and the central government, in order to provide the public with access to a wide array of digital applications. It represents one of the measures that was taken in the course of Denmark's digital development and was stipulated in the former digital strategy. All of Denmark's citizens can be authenticated with their NemID and receive secure access to their health data. Physicians also have a healthcare professional ID, which they need to use to access patient data.

Patients can use the sundhed.dk portal to mark as private the personal health information displayed there (the portal shows only the information that is saved on other servers), and thus limit physicians' access. Denmark has a centrally administered database for mandatory semantic classifications and clinical terminologies in hospitals. However, the focus is on secondary uses of data for research and statistical purposes, not semantic interoperability in the strict sense.

Many databases are not managed at the national level, such as the regional care databases or the municipal terminology servers. Some health datasets are consistently coded, while others are not. Diagnoses and medical procedures in hospitals that are coded by physicians using a standard are the most likely to be consistently coded.

Although there is no patient summary available, an EHR and a medication record that includes vaccination data are installed in the Danish health information network. Coordinating the care of chronic patients is not possible using the EHR, as the required level of detail is lacking. In these cases, physicians often still engage in bilateral discussions, or use other means of electronic communication in the form of a MedCom-operated health data network, an IT system specifically for medical institutions. Using this system, video conferences can be held, text messages and datasets exchanged, and cross-regional patient coordination can be organized, such as for multimorbid or chronic patients.

Digital health applications and services

ePrescriptions are used in Denmark by both hospitals and outpatient physicians. As the hospitals rely mainly on regional or local systems that cannot always communicate with the EHRs in physicians' practices, a national medication database was implemented, the Shared Medication Record. This provides information on patients' current medication and their vaccination status. Previously issued prescriptions are stored for two years and can be accessed by all physicians and pharmacies in Denmark that the patient grants this access to. Physicians are legally obliged to keep this record up-to-date, and all systems have to be able to gain access to this database. The ePrescription server allows the electronic transfer of prescriptions as well as their cancellation by the treating physician. The treating physician receives an automatically generated message as soon as medication is dispensed to a patient. The physician enters the medication prescription in their practice system, whereupon it is transferred to the Shared Medication Record. If a packet of medication is used up, but the patient needs to continue the course of medication, they can obtain another prescription online. The physician always records the exact period of time the patient needs to take the medication. The Shared Medication Record is a server-based application that runs on many platforms simultaneously and can be accessed by all of these platforms. All physicians can access these records using their own IT system (practice, hospital, community center, etc.), and all changes are automatically transferred from the server to all other platforms.[92]

As a platform, sundhed.dk allows the EHR to be displayed, but does not operate the server itself. The national rollout of telemedical services is currently being piloted for the documentation and monitoring of chronic lung patients in their own homes. Although the legislation does not present any obstacles to treating and diagnosing patients solely through telemedical services, the conditions for billing with the health insurance funds have not yet been regulated, so the technology applied is basically limited to emails and supporting technology. Appointments can be booked with outpatient physicians and with hospitals by means of their own websites and portals. Thus far, no central portal has been established for this. sundhed.dk offers more, however, than just access to digital health applications such as the medication record and the EHR; it provides the public with quality-assured health information, lifestyle tips, and specific advice on particular conditions. In addition, it allows the comparison of dental services and their prices.

Patients can amend the information in the EHR if it has been incorrectly entered. However, this process is manual and is not centrally managed. In general, the process takes so long that few make the effort. Patients cannot delete information on their own.

There are no official authorities for mHealth or health applications, but this will be a strategic objective in the coming years. The only monitoring program in the field of mHealth is currently being introduced for chronic lung patients, who will be able to use a tablet to enter everyday data independently, such as on blood pressure or sugar levels, as well as text information, and transfer this to a responsible hospital. In addition, every patient can visit sundhed.dk using the browser on their mobile device and access the EHR and medication record.

Data integration and exchange readiness

Both MedCom and the Danish Health Data Authority recommend the implementation of certain technical and semantic standards so that as many applications as possible in Denmark can communicate with each other, and to ensure that data can be exchanged across organizational boundaries. However, no implementation guidelines or assistance have been provided. There is no national terminology server in Denmark for all areas of the healthcare sector, and no binding terminology guidelines either (outside of hospitals). As such, only around 25 to 50 percent of the data and datasets are based on common terminological standards. Less than 25 percent of all healthcare institutions have stipulated common standards and terminology catalogues for internal documentation.[93]

The level of technical interconnection of electronic data sets is very high in Denmark, both for statistical purposes as well as for monitoring the quality and efficiency of the healthcare system. Over 75 percent of all datasets and databases are used for such purposes. The Danish government is taking part in projects for the transnational exchange of health data, but the implementation of these projects will not be completed for years to come.

92 Lykke, M., und Clement, K. (2014). *Shared medication record in general practice – A casestudy.* MD. Aalborg University.

93 Sources: national correspondent and survey results.

3.5.5 Actual use of data

All care sectors of the Danish healthcare system are 100 percent digitized and connected to the data network of MedCom. Less than 25 percent of all institutions across the country offer telemedical services.[94] However, ePrescriptions are already 100 percent implemented and used. The actual use of the EHR infrastructure in Demark varies greatly from region to region: usage rates in the Region of Southern Denmark (80 percent) and Region Zealand (76 percent) have the highest usage, followed by the North Denmark Region (69 percent), the Capital Region of Denmark (62 percent) and the Central Denmark Region (31 percent).[95] The following additional information systems are connected to the EHR, and allow the exchange of data:

- laboratory information systems
- medication information systems
- pathology information systems
- image archiving and communication systems (only reports, no images)
- vaccination registry

If a patient moves, over 75 percent of all general practitioners in medical practice exchange patient data with each other. In everyday practice, over 75 percent of general practitioners exchange data with hospitals and specialists in private practice.[96] It is legally permitted to use digitally saved patient data from EHRs for research purposes; this is done with certain types of data, while other types of data are too unstructured for this purpose. Data from ECGs, X-rays and other sources are also routinely collected and used for research purposes.

Quality and efficiency evaluations are often conducted based on health data from the EHR or other databases. Almost all patient data from the Danish healthcare system are used for this, coming from over ten databases. All data from the Danish patient registry are automatically transferred to the EHR. The following additional information is automatically added from regional or disease-specific databases:

- inpatient psychiatric data
- medical emergency data
- data from outpatient care
- medication and prescription information
- cancer registry data
- diabetes registry data
- cardiovascular registry data
- official long-term care data
- data collected from patients
- data from population health surveys
- census and registry data.

Despite the largely inconsistent application of common documentation and terminology guidelines, there are no government programs to train medical professionals in this area,

94 However, all hospitals are piloting the first national projects. Still, relatively few outpatient physicians offer these services.

95 Danish Government, Local Government Denmark, and Danish Regions, (2013). *Making eHealth work: National Strategy for Digitisation of the Danish Healthcare Sector 2013-2017.* [pdf] Available at: http://sum.dk/~/media/Filer percent20- percent20Publikationer_i_pdf/2013/Making-ehealth-work/Making percent20eHealth percent20Work.pdf.

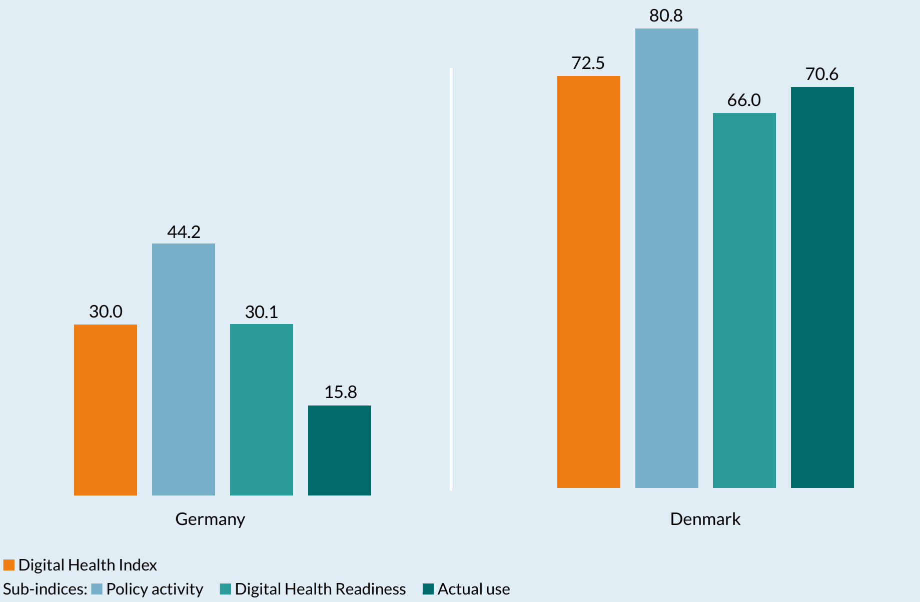
96 Sources: national correspondent and survey results.

or to highlight their benefits. Accordingly, less than 25 percent of all physicians exchange data that is based on common semantic coding and classification standards. Quality controls are not conducted on digitally saved clinical data. More than 75 percent of the Danish public have access to their own health information online. Between 50 percent and 75 percent of all patients visited sundhed.dk in 2017. In 2015, 1.5 million visitors viewed their EHR online.[97]

3.5.6 Digital Health Index: Comparison with Germany

The significantly higher score achieved by Denmark is the first thing of note when comparing the relative scores of the Digital Health Index and the sub-indices for Denmark and Germany. Of additional interest is the equilibrium of the three sub-indices, as well as the score of the actual use of data in comparison with the other values.

FIGURE 15: **Comparison between Germany and Denmark,** in the Digital Health Index and sub-indices



Source: Bertelsmann Stiftung

97 sundhed.dk, (2016). *Strategi for sundhed.dk: 2016–2018.* [pdf] Kopenhagen. Available at: https://www.sundhed.dk/content/cms/16/75816_sundheddk_strategirapport_2016_2018_web.pdf.

TABLE 11: **Digitalization profile Denmark**

						Policy activity and strategy
						Digital health strategies
	■				P1	Digital health is an integral part of general health policy
	■				P2	Political will to support data transfer and data exchange is advanced
	■				P3	An effective strategy to digitalise the healthcare system is in place
■					P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
		■			P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
■					P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
	■				P7	A national digital health entity has been established for oversight of digital health implementation
	■				P8	Digital health service refunding and financing is in place on the national / regional level
	■				P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
	■				P10	Legal frameworks in place to protect sharing of patient data
■					P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
■					T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
■					T2	Sufficient security actions are in place to secure patient privacy
■					T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
			■		T5	EPrescription services are operational
		■			T6	Telehealth and telemedicine can be routinely used
		■			T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
		■			T8	Patient control of content and access to the EHR
			■		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
	■				T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
			■		T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
■					T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
			■		T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
	■				A1	Digital health applications are a dominant solution for direct patient care
■					A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
		■			A3	Level of EHR uptake is high
	■				A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
	■				A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
	■				A6	For monitoring and improvement of healthcare systems health data is used regularly
■					A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
	■				A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung


Estonia
1.31 million inhabitants
45,339 km² area
28.9 inhabitants per km²
Digital Health Index
Score: 81.9
Rank 1

3.6 Estonia

3.6.1 The national healthcare system

Service provision

Estonia's healthcare system was redesigned when the country achieved independence in 1991, shifting from the Soviet Union's centrally organized and tax-financed system to decentralization and enforcement of user contributions. The health insurance system that emerged from these changes essentially grants every resident of Estonia the right to protection under statutory health insurance. This arrangement covers 95 percent of the population. While private health insurance is available, it is generally only used for protection abroad. Those insured under the public scheme can join statutory health insurance funds in the different regions. There are four regional directorates of the Estonian Health Insurance Fund (EHIF) which was established in 1993, and which enters into contracts with service providers. The EHIF initially fell under the control of the Ministry of Social Affairs, which was established at the same time, but since 2001 it has been a legally independent body.

Financing

Health expenditure is 80 percent financed by public bodies, with around two-thirds of all expenditure covered by the national health insurance system (in the form of the EHIF). The EHIF is financed by contributions, which are determined by income; employers pay 33 percent of social contributions, the self-employed pay the same rate, while employees pay nothing. Around half of those covered under the scheme remain exempt from contributions as they are not members of the contributing professions (e.g., children, pensioners, students, the unemployed, etc.). These contributions are partially covered by the state. The entirety of health expenditure is provided by the EHIF through supplementary payments and private services, as well as a small proportion of international subsidies (EU, World Bank, etc.), which in 2015 amounted to a comparatively low 6.3 percent.

Care provision

Services are provided on a decentralized basis through primary care, emergency treatment, outpatient and inpatient specialists, as well as nursing care. Most specialist services are still provided by hospital outpatient departments. The majority of outpatient facilities are now privately owned. There are around 50 hospitals for inpatient care.[98]

3.6.2 Development of digital health

With its X-Road infrastructure, which enables secure data exchange between all actors in the healthcare system (and the entire public sector), Estonia is one of the most digitally advanced countries in Europe. In 2005, the Ministry of Social Affairs secured subsidies from EU structural funds to develop four eHealth projects:

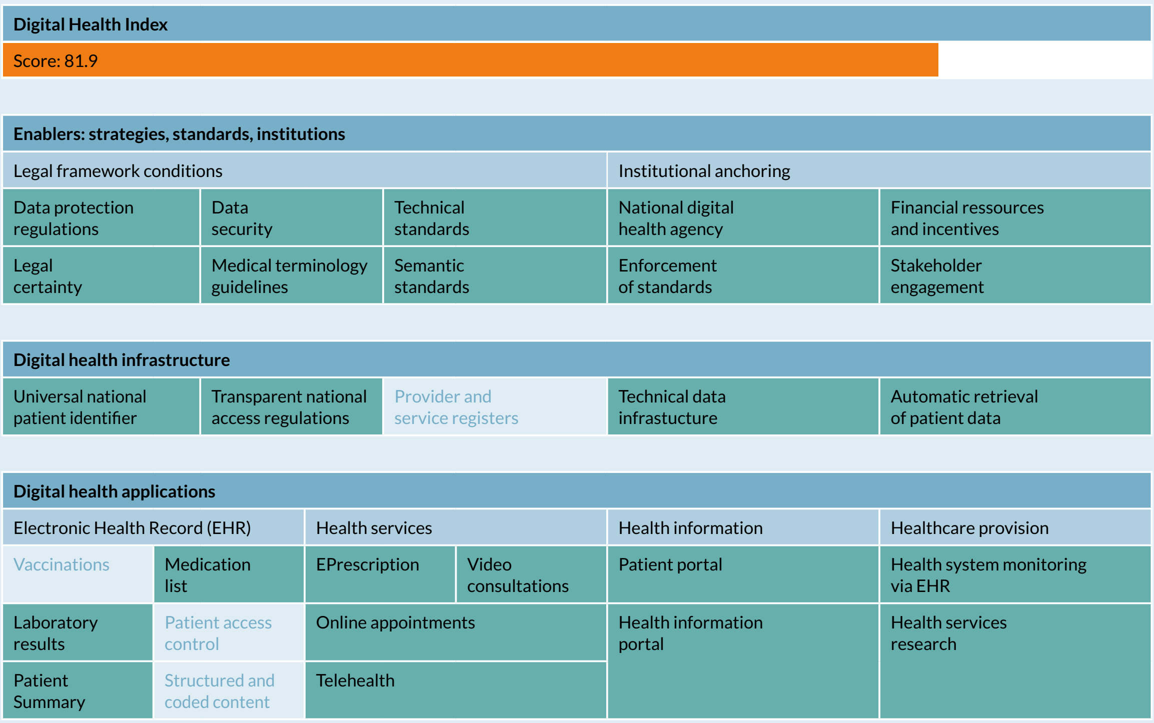
98 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

1. the electronic health record (EHR)
2. digital imaging
3. digital registration
4. ePrescriptions

These comprise Estonia’s health information exchange network (Estonian Health Information System, or ENHIS) which is linked to other public information systems and other registries that use public ICT solutions, such as the authentication system that supplies the information for a root directory of patients. ENHIS is established throughout the entire country and records practically the entire medical history of the population from cradle to grave.

The eHealth Foundation was established in 2005.[99] Estonia’s concept of a nationwide, integrated health information exchange for the entire population is based on a national, secure platform for data exchange, enforcement of the highest security standards for system access and user authentication, signature and encryption, and adherence with national statutory provisions concerning the collection and exchange of personal medical data.[100] Various international strategy papers such as the eHealth Action Plan i2010 and the Estonian Strategy for the Information Society 2013 underscore the Estonians’ belief that ICT acceptance must be accelerated in the healthcare sector.

FIGURE 16: **Map of digital health in Estonia**



■ available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

99 E-tervis.ee, (2018). *Estonian e-Health Foundation.* [online] Available at: http://www.e-tervis.ee/index.php/en/2012-07-22-13-35-31/organization.
100 *The Health Information System Act 2007. Government regulatory act of Health Information System 2008.*

Figure 16 summarizes existing digital health components in Estonia identified in the course of this study (green-shaded fields).

3.6.3 Policy activity and strategy

Digital health strategies

Both the Estonian eHealth Strategy 2020[101] and the Digital Agenda 2020 for Estonia,[102] successor to the Strategy for the Information Society 2013, place a great deal of emphasis on the key role of digital services, particularly in the healthcare sector. Digital health is intended to reform healthcare entirely, the desired outcome being a participatory, preventative and personal care system. The aim is for the entire corpus of personalized health data to be made available for risk group analysis by 2020 using the resources to hand, laying the foundation for shortened treatment pathways and easier diagnosis and decision-making for physicians. Manufacturers of digital healthcare services will continue to provide their data for evaluation programs and quality control.

Digitalization of healthcare has never been a matter of public discussion, nor has it been particularly promoted by individual politicians. Stakeholders and public institutions were involved to the extent that specifications for all public services were co-developed in the e-service unit of the Ministry of Social Affairs, and the government adopted the national digital health strategy in 2015.

Specific plans for the development and rollout of EHRs, mHealth, health information portals, big data and telemedicine services have been fully implemented for some years now; the health information portal since 2009, the ePrescription service since 2010, the health information exchange network since 2009 and in the area of telemedicine, doctors have been able to offer their patients video consultation since 2012.

The medical fraternity, as well as industry representatives, were consulted in the technical development of digital solutions in special committees. Performance objectives and cost-effectiveness analysis were defined and implemented in close cooperation with IT and consulting companies. Until last year, the most important body in this regard was probably the eHealth Foundation.

Institutional anchoring, financing and legal framework

Since 2004, individual digital health projects have been financed by the Ministry of Finance, with high-level figures for forthcoming investment documented as guidelines in strategy papers. All services are offered and carried out centrally by the state; medical facilities are “simply connected” and are not obliged to provide funding themselves.

There is no oversight for mHealth apps or applications. The eHealth Foundation – part of the eHealth unit of the Ministry of Social Affairs – assumed responsibility for all expenditure related to digital health in 2005, working closely with legislative authorities. Its three key functions were:

101 Tärnov, K. (2015). *Estonian eHealth Strategy.*

102 Ministry of Economic Affairs and Communications, (2014). *Digital Agenda 2020 for Estonia.* 1st ed. [pdf] Available at: https://www.mkm.ee/sites/default/files/digital_agenda_2020_estonia_engf.pdf

1. the development and operation of digital services in the healthcare system,
2. the development and dissemination of semantic standards, and
3. cooperation and innovation.[103]

In 2017, the eHealth Foundation merged with the e-service unit of the Ministry of Social Affairs. The resulting organization, the Health and Welfare Information Systems Centre (TEHIK), has since been responsible for the development of Estonian digital health services and the provision of ICT services on behalf of the Estonian Ministry of Social Affairs.[104]

The Health Insurance Fund reserves part of its budget for the (co-)development of digital solutions (e.g., electronic referrals) and their integration into routine healthcare throughout the country. There are no additional costs for patients taking advantage of digital healthcare services, as the "analog" alternative, such as a written prescription or referral letter, is simply no longer used, and any additional costs incurred in the transition are absorbed by the insurer.[105]

Project implementation between 2005 and 2009 included funding for training programs. Most universities and medical faculties offer their students digital health courses, and the Tallinn University of Technology even offers a Health Care Technology Master program.

A special regime of laws and ordinances was created to regulate the exchange of health data. The Health Services Organisation Act defines the general foundation for the functioning of the ENHIS. On the other hand, there is no dedicated regulation system for EHRs, which healthcare service providers capture in their own local databases. This means that EHRs that are not synchronized with the central ENHIS database are subject to general requirements for the processing of medical records. Patient consent is not required for the creation of EHRs, nor for them to be shared for the purposes of healthcare.

Estonian law provides for an opt-out for the transfer of ENHIS data; patients may make individual EHRs inaccessible within the ENHIS, or all of them. Documentation of healthcare services (i.e., the obligation to report on the provision of such services) is regulated by the Health Services Organisation Act and the Regulation on the Documentation of Provision of Healthcare Services and the Conditions and Arrangements for the Retention of these Documents.[106]

The Personal Data Protection Act applies to all sensitive personal data protection issues related to EHRs. Any Estonian physician is able to access ENHIS data for any patient, as long as the healthcare service provider for whom they work has a valid Estonian activity license, unless the patient has prohibited access to his or her ENHIS data. Patients are the owners of their health data and can view the access log to their ENHIS data on the patient platform "My E-Health." As a rule, patients have full access to all of their ENHIS data.

Estonian legislation does not stipulate a more specific legal regime for liability related to processing EHRs. Therefore, the general principles for malpractice apply.[107] ENHIS data

103 E-tervis.ee, (2018). *Estonian e-Health Foundation.* [online] Available at: http://www.e-tervis.ee/index.php/en/2012-07-22-13-35-31/organization.
104 Digilugu.ee, (2018). *Patient Portal.* [online] Available at: https://www.digilugu.ee/login?locale=en.
105 Sources: national correspondent and survey results.
106 Regulation on the Data Content of Documents Transferred to the Health Information System and the Conditions and Arrangements for the Retention of these Documents 2008.
107 Lepasepp, K., Matjus, M., and Haamer, M. (2014). *Overview of the national laws on electronic health records in the EU Member States: National Report for the Republic of Estonia.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_estonia_en.pdf.

is archived indefinitely. Archiving of ENHIS data is regulated by the Statute of Health Information System. Secondary use of EHRs is allowed for scientific research or statistics and is primarily regulated by the Health Services Organisation Act and the Personal Data Protection Act.

3.6.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Every citizen has an electronic personal identity card which regulates access to all public services. Smart-ID authentication software uses two-factor authentication, with the patient able to access using a PIN or through a mobile device. Healthcare personnel are authenticated and identified through their employer; they don't require their own healthcare personnel identity card to retrieve patient data – from the patient's electronic health record, for instance.

Patients have full control over physicians who can and cannot retrieve health data. Within the health information exchange network, too, all patient-related data is de-identified so that no reference can be made to the individual. TEHIK has defined a uniform procedure for this. A particular feature of the Estonian digital health system is that uniform classifications, standards and terminologies have been developed and published for the description, documentation and digital transfer of diseases, symptoms and conditions.[108] These classifications, standards and terminologies are in an advanced state of development, and the TEHIK and the Ministry of Social Affairs organize training for medical professionals to improve standardized usage.

Since 2008, all state-recognized service providers in the healthcare sector have been required to log their patients' EHRs with the ENHIS. Healthcare service providers must enter into an agreement TEHIK before they are granted access to the network. This is an overarching national system that exists in the healthcare sector alongside the IT systems of the individual service providers. The law determines which types of health data must be uploaded to the ENHIS. This data is automatically uploaded and synchronized, either overnight or manually.[109]

Digital health applications and services

The ePrescription service allows citizens to purchase medication in any pharmacy in Estonia by using electronic identification. When a physician issues an ePrescription, it is automatically uploaded to the ENHIS. Pharmacists anywhere in Estonia can then download the prescription, see the dispensing status, log the dispensing of medication and view other medication that has been prescribed.

Video consultation and remote diagnosis (physician-to-patient and physician-to-physician) are permitted by law and are integrated into routine outpatient care. A uniform system for remote monitoring of patients has only been implemented in individual cases at the local level. The focus of previous digital health strategies on patient-oriented care resulted

108 E-tervis.ee, (2018). *Tervise ja Heaolu Infosüsteemide Keskus.* [online] Verfügbar: http://pub.e-tervis.ee/.
109 Lepasepp, K., Matjus, M., and Haamer, M. (2014). *Overview of the national laws on electronic health records in the EU Member States: National Report for the Republic of Estonia.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_estonia_en.pdf.

in a significant expansion of the service spectrum for patients. Through the health information portal digilugu.ee, every Estonian citizen can access the ePrescription service, book an appointment with their general practitioner online, view personal health data in the ENHIS and get information on general health and disease-related issues.[110]

Along with these access rights related to patients and their digitally stored data, patients can also have incorrect data rectified. However, this requires contacting the relevant physician, who retains the original data. mHealth only exists in Estonia in the form of mobile access to patients' own electronic health records. Health apps and other portable applications are only used locally in a few facilities.

Data integration and exchange readiness

A particular feature of the Estonian digital health system is that uniform classifications, standards and terminologies have been developed and published for the description and codification of conditions, symptoms and conditions. As these are mandatory for all healthcare service providers, uniform usage is high. Over 75 percent of healthcare facilities in all sectors have introduced uniform terminological guidelines that must be used in the codification and classification of data.

All EHRs in Estonia are able to communicate with the ENHIS, exchange data and also make it this data available to other databases in the research field. Because health data is exclusively electronically documented, every Estonian has at least an electronic health record, from which the most important information can be retrieved through the ENHIS. The data of foreign patients who are treated in Estonian hospitals is already being transferred to the ENHIS in the same manner as the health data of local patients. There are also data exchange agreements with a number of countries and a legal framework that enables data exchange with transnational health networks.

3.6.5 Actual use of data

100 percent of physicians, specialists, hospitals and pharmacies are linked to the health information exchange network ENHIS; over 75 percent retrieve data or actively exchange information with each other and offer telemedicine services. More than 75 percent of all prescriptions are electronic.[111] The following information systems are also linked to patient records and the ENHIS:

- laboratory information systems
- medication information systems
- image archive and communications systems

As the operator of ENHIS, TEHIK also makes available data for further research-related and statistical purposes. Between 4 and 10 different information systems and datasets, which represent 76-100 percent of the population, are also used for the analysis of healthcare system performance in outpatient care.[112] The following information types are synchronized with the ENHIS from all local electronic health records:

110 Sources: national correspondent and survey results.
111 Sources: national correspondent and survey results.
112 Sources: national correspondent and survey results.

TABLE 12: **Digitalization profile Estonia**

						Policy activity and strategy
						Digital health strategies
	Almost fully				P1	Digital health is an integral part of general health policy
			To some extent		P2	Political will to support data transfer and data exchange is advanced
Fully					P3	An effective strategy to digitalise the healthcare system is in place
Fully					P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
Fully					P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
		Partly			P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
Fully					P7	A national digital health entity has been established for oversight of digital health implementation
Fully					P8	Digital health service refunding and financing is in place on the national / regional level
Fully					P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
Fully					P10	Legal frameworks in place to protect sharing of patient data
Fully					P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
	Almost fully				P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
		Partly			T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
Fully					T2	Sufficient security actions are in place to secure patient privacy
Fully					T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
	Almost fully				T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
Fully					T5	EPrescription services are operational
	Almost fully				T6	Telehealth and telemedicine can be routinely used
		Partly			T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
	Almost fully				T8	Patient control of content and access to the EHR
			To some extent		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
Fully					T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
Fully					T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
Fully					T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
Fully					T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
Fully					A1	Digital health applications are a dominant solution for direct patient care
Fully					A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
	Almost fully				A3	Level of EHR uptake is high
	Almost fully				A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
	Almost fully				A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
		Partly			A6	For monitoring and improvement of healthcare systems health data is used regularly
		Partly			A7	Automatic extraction of health data from EHR systems to national databases is pervasive
			To some extent		A8	The quality of data and clinical content of electronic records being shared among providers is high
			To some extent		A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung

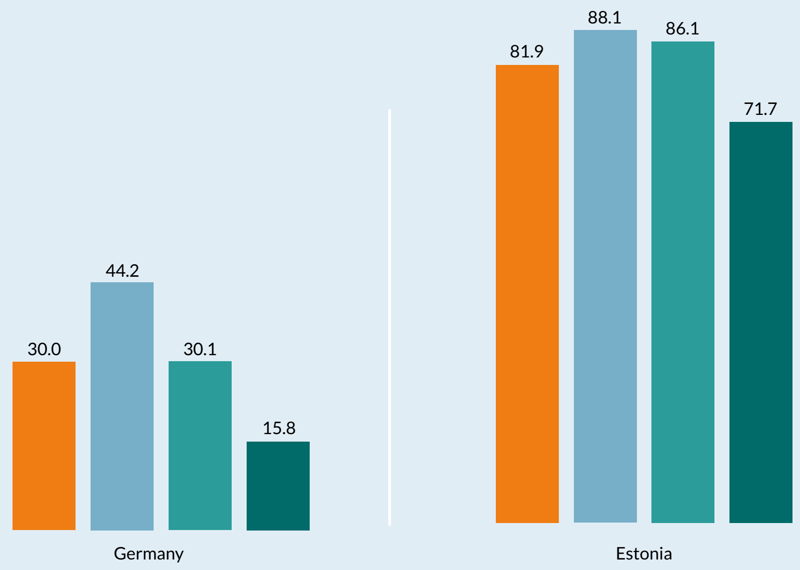
- medical emergency data
- data from outpatient care
- medication and prescription information
- cancer registry data

Although semantic standards and guidelines are mandated in most healthcare facilities, only 25-50 percent of all physicians document their data using these uniform standards. TEHIK has consequently made funding measures available to train and promote medical personnel in this area. Every patient can see their own health data via the national health information portal. In 2017, between 50 and 75 percent of all patients gained information on a health-related issue through a health information portal. For patients in acute or intensive care, on the other hand, the figure is less than 25 percent. But overall, only a small section of the population seeks information on health issues – less than 25 percent.[113]

3.6.6 Digital Health Index: Comparison with Germany

A comparison of findings for Estonia and Germany reveals that Estonia scores higher for every value. Estonia has twice as many percentage points in each category, with similarly high results for the sub-indices of policy activity and digital health readiness.

FIGURE 17: **Comparison between Germany and Estonia,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity Digital Health Readiness Actual use
Source: Bertelsmann Stiftung

113 Sources: national correspondent and survey results.


France
64.51 million inhabitants
543,965 km² area
118.6 inhabitants per km²
Digital Health Index
Score: 31.6
Rank 15

3.7 France

France is another country that will be analyzed more closely in Section II. This country report consequently represents a digest of that analysis. This chapter is based on research and the results of the benchmarking survey, while the more thorough analysis of France is additionally based on study-related visits and further local interviews, as described in the section discussing methodology.

3.7.1 The national healthcare system

Service provision

The French healthcare system is organized as a social-insurance system. With the introduction of mandatory insurance in 2000, the statutory health insurance system now compulsorily covers the entire population. Membership is primarily based on the criterion of employment and there is no mandatory insurance threshold. Family members who are not in the labor market are co-insured. Private health insurance provides complementary coverage for services not provided by the public system. For historic reasons the health insurance fund landscape is broken down by profession, however it offers a near uniform catalog of services.

Financing

In 2015, state health expenditure amounted to 11 percent of GDP. The financing model for the French statutory health insurance system is based on social-insurance contributions, earmarked levies, a contribution determined by the state based on gross wages, and other earmarked taxes.

For treatment, 30 percent of costs are generally borne by patients themselves. For hospital treatment there is a supplementary payment amounting to 20 percent of costs, and a fixed charge of €18 is payable for each day of inpatient care. The supplementary payment for medication fluctuates between 0 percent and 85 percent, for remedies and aids it is as much as 65 percent-100 percent. Exemption from supplementary payments is only granted to those on disability or occupational injury pensions, as well as low-income earners. There are reductions for the chronically ill and for children. The scope of services in France's statutory health insurance system is comparable with the equivalent German system in terms of medical benefits – although it has higher excesses. In the event of illness, sickness benefits and maternity allowance are included. An essential difference compared to Germany is that services provided by outpatient physicians and dentists as well as pharmaceutical supplies are rendered on the cost reimbursement principle; the benefit in kind principle only applies to inpatient care.

Care provision

General practitioners and specialists usually work in independent, individual practices. The law enforces the gatekeeper function of general practitioners by reducing practice fees for specialists from €5 to €1 if the consultation results from a referral by the general practitioner. In the inpatient care sector, France has a plural sponsor structure; around a quarter of all hospitals, and around two-thirds of all beds, belong to the public sector and are under municipal ownership. There are similar proportions of not-for-profit and private hospitals; patients can choose freely between these options. With 6.8 beds per 1,000 residents, France is significantly ahead of the OECD average (4.7 beds).[114]

3.7.2 Development of digital health

In 2004, the French government laid the legislative cornerstone for the development of an electronic health record – the Dossier médical personnel (DMP). The goal: unrestricted web access to patient data at any time, from any location. A government agency, ASIP Santé, led the program and was monitored by information security authorities. The agency for the modernization of the information system infrastructure in hospitals coordinated adjustments to individual applications to make them DMP-ready.

Following significant initial difficulties, the first projects were piloted in 2005. However, evaluations indicated a low rate of acceptance among the population, minimal activity on pages for medical personnel, problems with data transfer (some advanced clinics used up to 50 different internal communications systems) and a lack of integration with hospital information systems. In response, a compatibility catalogue was created so that manufacturers could be sure that their information systems were DMP-compatible and that data exchange would be assured. New regional pilot projects were launched in late 2010. The aim was for patients to determine which sub-databases would be able to integrate with the DMP (e.g., billing systems, ePrescription, etc.) and physicians would have to identify themselves with an electronic ID before they could retrieve or add information. There was also a technical hotline that users could contact with any questions or problems. Because of the numerous problems and high maintenance costs, the DMP was suspended between 2010 and 2016. The program was restarted when the national health insurance fund (CNAM) took over the DMP in 2016.[115] Because the DMP is optional and efficient usage greatly depends on the patient's motivation, there are currently considerations afoot for restructuring the DMP to make it health-specific.

As well as the decision on the DMP in 2004, there were parallel efforts on the part of the pharmacist fraternity to develop their own electronic record that would enable a complete overview of medication and exchange of relevant data in this area. In 2007 the development of the Dossier Pharmaceutique (DP) was released as an opt-out system and in 2008 approved for nationwide rollout by law. With the Carte Vitale (health insurance card), customers can retrieve their DP in pharmacies at any time while retaining full control over who else can see this data. The type of medication, duration of the prescription, dispensing location and time as well as any vaccinations are stored for a minimum of three but no more than 21 years and are archived for a further 32 months following expiry. The DP has also introduced an innovation to this field; using comprehensive data, pharmacies can recall entire batches by messaging patients in the event of incorrect dispensing or unforeseen side effects. By 2016 around 30,000 different pharmacies and healthcare facilities were registered in the system. With 32 million active DP files it is far more successful than the DMP itself,[116] and has achieved a patient satisfaction rate of 98 percent.

114 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

115 Ministère de la santé, de la jeunesse, des sports et de la vie associative, (2016). *Modernisation des Etablissements de Sante.* Paris.

116 The DP is automatically closed after three years' inactivity.

FIGURE 18: **Map of digital health in France**

Digital Health Index
Score: 31.6

Enablers: strategies, standards, institutions				
Legal framework conditions			Institutional anchoring	
Data protection regulations	Data security	Technical standards	National digital health agency	Financial ressources and incentives
Legal certainty	Medical terminology guidelines	Semantic standards	Enforcement of standards	Stakeholder engagement

Digital health infrastructure				
Universal national patient identifier	Transparent national access regulations	Provider and service registers	Technical data infrastructure	Automatic retrieval of patient data

Digital health applications					
Electronic Health Record (EHR)		Health services		Health information	Healthcare provision
Vaccinations	Medication list	EPrescription	Video consultations	Patient portal	Health system monitoring via EHR
Laboratory results	Patient access control	Online appointments		Health information portal	Health services research
Patient Summary	Structured and coded content	Telehealth			

■ available (two thirds of the questions answered positively)

Source: Bertelsmann Stiftung

More precise objectives in the digital health field were laid out in the 2016 "Stratégie nationale e-santé 2020." The strategy is built on four pillars: big data as support in treatment and care, closer collaboration between actors and innovation incentives, elimination of bureaucratic hurdles and the development of telemedicine for simplified access to medical care and putting information security on the national agenda. It places the DMP at the heart of future-oriented medical care in France.[117]

Figure 18 summarizes existing digital health components in France identified in the course of this study (green-shaded fields).

3.7.3 Policy activity and strategy

Digital health strategies

France's first strategy for the digitalization of the healthcare sector was released in 2016 and focused on selected services for the support of healthcare provision, and above all improvements in cost effectiveness and decision-making for physicians using big data and telemedicine services. Digital health is regarded as a integrated component of general healthcare rather than just an "add-on." The legislation passed in this context creates the necessary framework for the regions, who decide for themselves which type of services and solutions they wish to implement locally.

117 Ministère des Affaires sociales et de la Santé, (2016). *Stratégie nationale e-santé 2020*. Paris.

At the national level, digital health is not driven by political parties or particular individuals. The regions assume responsibility for incremental piloting and project evaluations. Implementation plans and corresponding schedules were by the government for the reintroduction of the DMP in 2016, the introduction of regional ePrescriptions and telemedicine services, and for the expansion of the French health information portal santé.fr, but not for an interoperability strategy. The national pharmacists' association was primarily responsible for the development of the DP, and besides the national health insurance fund and the Ministry for Solidarity and Health otherwise there are no other stakeholders involved in the development of digital health solutions.

Institutional anchoring, financing and legal framework

In financial terms, France has not determined a dedicated budget for meeting the objectives of the new 2020 strategy. Similarly, there has been no regulation or introduction of funding measures for innovative mobile digital health apps. France has no digital health agency with a comprehensive portfolio of functions and competencies. Instead, individual departments within the Ministry for Solidarity and Health and other organizations assume elements of this responsibility within the French digital health system. Adherence to standards of interoperability and security of health information systems and their integration into the industry's range of digital products is a high priority for ASIP Santé.

The standards for interoperability validated by ASIP Santé in the form of certificates represent a "national interoperability framework" that is developed and maintained together with actors in the healthcare sector and the industry. With the 2016 law for the modernization of the healthcare sector, the continuation and renewal of the DMP as an integrated EHR were transferred to the national insurer CNAM, having initially been developed and operated by ASIP Santé.[118]

The Strategic Committee for Digital Health (CSNS) was established in 2017. It is designed to function as a coordinating body bringing industry actors, representatives of the medical profession and healthcare facilities, patient associations and the ministry to the table, and to ensure and harmonize implementation of the national digital health strategy in four project groups.[119] Since 2016, the Institut Santé publique France, which is responsible for health development research and analysis, public awareness, and consultation, has maintained a health information portal with secure health information and preventative measures.

National programs like the Territoire de soins numérique (TSN) program provide funding for the implementation of innovative technologies in the area of communications between healthcare service providers in the regions.[120] The CNAM also reserves part of its budget for the further development, reimbursement and rollout of its digital healthcare services. While there are performance objectives defined for the rollout of new DMPs, for example, and associated digitalization of patient records, there are no monetary penalties for non-fulfillment by public authorities.

118 Cour des Comptes, (2018). Les services publics numériques en santé: des avancées à amplifier, une cohérence à organiser. *Le rapport public annuel 2018 de la Cour des Comptes,* p. 215–239.

119 Ticsante.com, (2018). *Medasys.* [online] Available at: http://www.ticsante.com/le-comite-strategique-du-numerique-en-sante-a-tenu-sa-premiere-reunion-NS_3364.html.

120 Solidarites-sante.gouv.fr, (2018). *Le programme Territoire de Soins Numérique – TSN.* [online] Available at: http://solidarites-sante.gouv.fr/systeme-de-sante-et-medico-social/e-sante/sih/tsn/article/le-programme-territoire-de-soins-numerique-tsn.

At the legislative level, patient data protection legislation has been expanded in recent years and new regulations introduced for the exchange and archiving of patient data between organizations through the DMP. The corresponding laws stipulate the rights of patients in relation to their medical records and corresponding obligations of physicians. The law does not provide any more detail on the liability of medical professionals in the event of malpractice in connection with medical products and EHRs.[121]

The interoperability framework developed by ASIP Santé, and the semantic standards and other guidelines it contains, are only mandatory for suppliers and service providers once the ministry imposes an enforcement ordinance. This may be imposed for guidelines and standards at the suggestion of ASIP Santé but never for multiple instances simultaneously. The data in the DMP may be used for the purpose of health research. As yet only a few organizations and educational institutions offer (further) training programs for usage and handling of digital health programs.

3.7.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

An insured individual currently has multiple identifiers within the healthcare system. The social security number is used for billing healthcare services, for instance, while hospitals and outpatient physicians each use a specific identifier for their patients in medical aftercare. However, ASIP Santé is currently piloting a project which is set to be implemented nationally by 2020, which will enforce the social security number as a unique identifier of patients throughout the entire healthcare system.[122] This has already been implemented for healthcare professionals.

Since the rollout in 2011, patients have a high degree of control over their data in the DMP. They can decide which data and documents can be seen by physicians (besides their general practitioner), they can remove data and documents if they contain errors and, where there is good cause, completely block access to the DMP for certain physicians. The DMP cannot be created without the consent of the patient. The data within the system is not encrypted or anonymized.

Medical information standards and technology guidelines are not centrally defined by a dedicated authority. The various providers of digital health solutions must merely adhere to prescribed statutory interoperability standards where they exist.

Patient summaries are planned as an expansion of the DMP, but concrete proposals for implementation are still pending. While the infrastructure for the DMP itself is available, its implementation throughout France remains patchy. Nor are there automated synchronization mechanisms between local patient medical records in hospitals and medical practices with the DMP, meaning that all documents must be fed in manually.

121 These can include: misdiagnoses, treatment errors, documentation errors, insufficiently informing patients, and mistakes relating to the division of labor between different physicians.
122 Sources: national correspondent and survey results.

Digital health applications and services

While the Dossier Pharmaceutique is not an ePrescription service in the sense of allowing digital transfer of prescriptions, it does offer physicians and pharmacists a comprehensive view of the patient's prescribed medications with valuable information that can help prevent duplicate or incorrect prescriptions.

While diagnosis and treatment of patients through telemedicine services is allowed by law, it was only legally defined as a billable service in 2018.[123] The means of financing these services should be defined by mid-2019. The first regional pilot projects are already under way, with the initial focus very much on physician-to-patient communication. Physician-to-physician communications is enabled by the messaging service MSSanté, operated by ASIP Santé.[124] MSSanté is not just a messaging service, it also combines all electronic post services (mostly private) which adhere to defined security standards and guarantee confidentiality of exchange.

France has national health information portals in two different formats:

1. amelie.fr: with around 25 million user accounts, this is the most used health information portal in France. It primarily handles issues around cost reimbursement and billing. Beyond their own accounts, insured individuals can also view databases of healthcare providers. This provides them with information on their specialization, address, average treatment costs and amount of cost reimbursement through the health insurance fund;
2. santé.fr: the implementation of santé.fr was included in the law for the modernization of the healthcare system introduced in January 2016 (see above). This is intended to function as a health information portal in the future, with general information on diseases and health issues, as well as access to data through facilities and specialists in the healthcare system. Until September 2017 it was only implemented as a pilot project in the Paris region, and is currently being expanded at the national level. The health information portal is set to be expanded to cover the whole of France in the first half of 2019. Presently it does not actually provide health information, rather it functions solely as a search engine for health-related articles on the internet and for healthcare facilities in pilot regions. There are no plans for mobile monitoring of patients or mobile access to different health information or services.[125]

Data integration and exchange readiness

While ASIP Santé is responsible for the establishment and dissemination of the interoperability framework, this remains largely incomplete. No standards have yet been completely enforced, and there is no defined timeframe for mandatory rollout. Despite requests from software manufacturers and providers of health data hosting wishing to pre-plan future development in this area as best they can. Around 25-50 percent of all healthcare facilities have introduced uniform internal guidelines that define how medical data needs to be electronically documented. Around the same proportion of national databases are based on a standardized terminology and coding catalog.

123 *LOI n° 2017-1836 de financement de la sécurité sociale pour 2018(1) 2017.*
124 mailiz.mssante.fr, (2018). *MSSanté.* [online] Available at: https://mailiz.mssante.fr/home
125 Sources: national correspondent and survey results.

Quality and efficiency analysis of the healthcare system through billing information is technically feasible – much as it is in Germany. However, the linkage of the databases required for this is not yet completely established.[126] There are high barriers and conditions for using other medical documents in this regard, and for other research purposes. Legally health data may be transferred to other European countries, but there are no technical or normative regulations in this regard.

3.7.5 Actual use of data

For general practitioners in medical practice and specialists, there is a great deal of variation in the degree of electronic documentation of health data – between 25 percent and 50 percent of general practitioners and more than 75 percent of specialists still use paper files in their practices.[127] Fewer than 25 percent of facilities in outpatient and inpatient care are linked to pharmacies through the medication database DP, and telemedicine services are only offered in isolated cases. Prescriptions are not sent digitally.

It is only laboratory tests and similar documents that are stored alongside billing data to date. Data exchange between general practitioners largely takes place through MSSanté in the form of emails. As the DMP can only be shared with other physicians via patients, and physicians themselves can only gain access in proven emergencies, there is barely any exchange between healthcare facilities themselves. Options for secondary usage of medical data are highly restricted under French law.

Billing data is used for monitoring the healthcare system, with almost the entire population covered with respect to healthcare and health products. The DMP is not used for general promotion of public health. There is no automatic data transfer between local hospital and medical practice IT systems and the DMP.

While some healthcare facilities have introduced certain guidelines and standards related to documentation of clinical data, implementation lags a long way behind. Fewer than 25 percent of all physicians in the outpatient and inpatient care sectors structure their clinical notes in a standard way using prescribed terminology guidelines.[128] Consequently, the DMP only contains unstructured documents and data, which are often impossible to compare or otherwise interpret.

There are no state-run quality checks or programs for promoting uniform coding and documentation in the healthcare sector. In theory, every French person can see their billing data (amelie.fr) and in some regions they can also retrieve their own medical data from the DMP. However, fewer than 25 percent of patients accessed their DMP or the health information portal santé.fr in 2017.[129, 130]

126 Cour des Comptes, (2018). *Les services publics numériques en santé: des avancées à amplifier, une cohérence à organiser. Le rapport public annuel 2018 de la Cour des Comptes,* p. 215–239.
127 Sources: national correspondent and survey results.
128 Sources: national correspondent and survey results.
129 The question related to usage of the portal at the national level. However, to date it is only available in a few regions. The rate of usage and awareness in these regions is not known.
130 Sources: national correspondent and survey results.

TABLE 13: **Digitalization profile France**

						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
			■		P2	Political will to support data transfer and data exchange is advanced
		■			P3	An effective strategy to digitalise the healthcare system is in place
				■	P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
				■	P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy’s institutional backing, financing, and legal framework conditions
				■	P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
		■			P7	A national digital health entity has been established for oversight of digital health implementation
		■			P8	Digital health service refunding and financing is in place on the national / regional level
			■		P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
			■		P10	Legal frameworks in place to protect sharing of patient data
		■			P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
			■		P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
		■			T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
		■			T2	Sufficient security actions are in place to secure patient privacy
				■	T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
				■	T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
			■		T5	EPrescription services are operational
			■		T6	Telehealth and telemedicine can be routinely used
				■	T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
			■		T8	Patient control of content and access to the EHR
				■	T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
	■				T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
				■	T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
			■		T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
				■	T13	Patient data can be transferred securely and automatically to trans-national data networks *(e. g. the EU Connected Europe Facility [CEF])*
						Actual use of data
			■		A1	Digital health applications are a dominant solution for direct patient care
				■	A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
				■	A3	Level of EHR uptake is high
				■	A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
			■		A5	Data sharing with third parties (e. g. analysts or researchers) is common and intended to generally improve healthcare system performances
		■			A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
			■		A9	Patient portals offering access to personal healthcare information are highly frequented

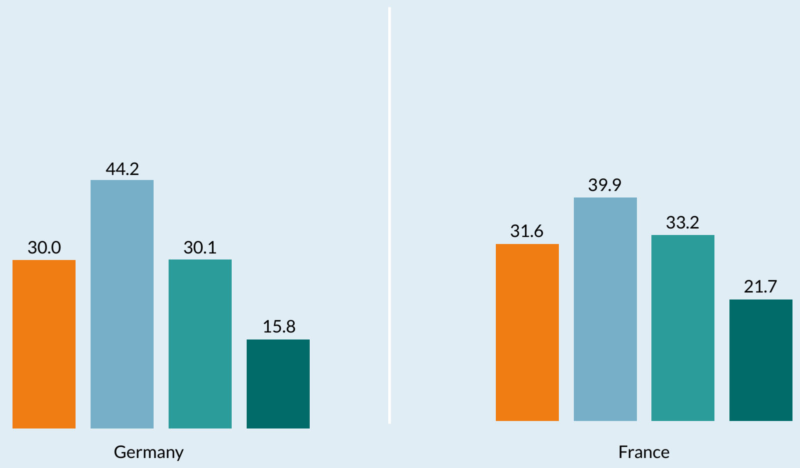
■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung

3.7.6 Digital Health Index: Comparison with Germany

In comparison with Germany, a view of the respective points for the Digital Health Index and all three sub-indices shows a similar picture. Both countries score highest in policy activity, and lowest for actual use of data.

FIGURE 19: **Comparison between Germany and France,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity Digital Health Readiness Actual use
Source: Bertelsmann Stiftung


Israel
8.63 million inhabitants
20,766 km² area
415.6 inhabitants per km²
Digital Health Index
Score: 72.4
Rank 4

3.8 Israel

Like France and Denmark, Israel is another country that will be analyzed more closely in Part II. This country report, on the other hand, is a digest of the results of the benchmarking survey, while the more thorough data and analysis of Israel is additionally based on study-related visits and further local interviews.

3.8.1 The national healthcare system

Service provision

The Ministry of Health is responsible for healthcare policies in Israel. Its core functions include administering the state healthcare budget, developing legislation, introducing and monitoring medical and health standards, certifying medical personnel, promoting research and development, and regulating the healthcare sector. It owns and operates almost half of the national hospitals.

In January 1995, a national health insurance law came into effect, which was designed to help render healthcare provision more cost effective. This resulted in a mandatory healthcare system based on four not-for-profit service providers, namely the health maintenance organizations (HMO) Clalit, Leumit, Maccabi and Meuhedet. The largest is Clalit, which covers around 60 percent of the population.[131]

Financing

Israel's health expenditure represented 7.4 percent of GDP in 2015 – comparatively low by European standards. Every member pays a contribution proportional to their income and has the right to the same quality and the same medical services. Every citizen has the right to take advantage of a standardized service catalog which is defined by the Ministry of Health. Each year this catalog is formally evaluated and updated. The four competing HMOs are independent, but they operate within a legal and regulatory framework defined by the government. Citizens may choose freely between them and cannot be rejected by the HMO.

The Ministry of Health collects premiums from citizens on the basis of income. As income increases so too health insurance contribution rates, from 3.8 percent to a maximum of 4.8 percent. The government then distributes these funds to the HMOs in accordance with their membership base, with additional weighting based on certain factors such as the age of members. In addition, citizens pay excesses on their treatment costs, which currently equates to a maximum of USD 150 per month.

Care provision

Israel has a nationwide primary care system. The costs for house calls are generally fully covered. Most medical professionals in the healthcare sector work for the aforementioned HMOs, either as employees or independent physicians. They function as gatekeepers to other healthcare services such as specialists and hospitals. Both outpatient and inpatient care are rendered either in the practices of general practitioners or in "community centers." Hospitals are responsible for specialized medical care. In Israel there are 48 general hos-

131 clalit-global.co.il (2018), *The Story of Clalit Health Services.* [online] Available at: http://www.clalit-global.co.il

pitals with around 1.6 beds per 1,000 residents (OECD average: 4.7 per 1,000 residents). The government owns almost half of these, with around 30 percent belonging to Clalit, 16 percent in public ownership and 8 percent private.[132]

3.8.2 Development of digital health

Israel has pursued developments in the field of digital health since the late 1990s. Following the 1995 healthcare system reform, the four major HMOs recognized the potential of electronic availability of their patients' data and decided on initial investments. However, initial projects for exchanging digital records and faxes failed due to data security problems. As a response, initial, minimal datasets were defined; these were intended to simplify the exchange of data and were based on data that physicians required for treatment.

In the early 2000s, the various healthcare facilities of the largest provider Clalit were using dozens of different information systems for various departments at any given time, prompting renewed calls for a system that would allow simple retrieval of information within the organization's own facilities. This led to the development of the internal health information exchange network OFEK, which put bottom-up development in motion and now covers 70 percent of the Israeli population. However, there is no national, uniform infrastructure, with an absence of government influence and cooperation between the

FIGURE 20: **Map of digital health in Israel**

Digital Health Index
Score: 72.4

Enablers: strategies, standards, institutions				
Legal framework conditions			Institutional anchoring	
Data protection regulations	Data security	Technical standards	National digital health agency	Financial ressources and incentives
Legal certainty	Medical terminology guidelines	Semantic standards	Enforcement of standards	Stakeholder engagement

Digital health infrastructure				
Universal national patient identifier	Transparent national access regulations	Provider and service registers	Technical data infrastucture	Automatic retrieval of patient data

Digital health applications					
Electronic Health Record (EHR)		Health services		Health information	Healthcare provision
Vaccinations	Medication list	EPrescription	Video consultations	Patient portal	Health system monitoring via EHR
Laboratory results	Patient access control	Online appointments		Health information portal	Health services research
Patient Summary	Structured and coded content	Telehealth			

■ available (two thirds of the questions answered positively)

Source: Bertelsmann Stiftung

132 Rosen, B., Waitzberg, R., and Merkur, S. (2015). Israel – Health System review. *Health Systems in Transition.* 17(6). 2016, 8 (1&2), p. 112-121.

HMOS absent following the 1995 reform which persisted until 2010 or so. Only recently has the government exerted increasing influence on the regulation of health information exchange and promoted a project for the development of an independent network that encompasses all HMOs.

Figure 20 summarizes existing digital health components in Israel identified in the course of this study (green-shaded fields).

3.8.3 Policy activity and strategy

Digital health strategies

In Israel, the four HMOs rather than the state or the Ministry of Health engage with digital health strategies and provision of individual services. The state merely defines a high-level health policy framework. The healthcare system in Israel has been digitized for 20 years, and this was a bottom-up process – beginning with the aforementioned rollout of electronic clinical records by the HMOs in the mid-1990s.

It is only in the last ten years or so that the Health Ministry has taken an active role in the digitalization of the Israeli healthcare sector.[133] Digital healthcare has received political support for some years as part of "Digital Israel" – a government initiative for promoting digitalization and innovation in every area of life.[134] The influence of political processes and negotiation on this development have been minimal. Instead, a political framework has been created that set the parameters within which free, technological competition may occur. The "National Digital Health Plan" published in March 2018 comes with a budget of around USD 264 million. Of this, USD 177 million is being invested in the establishment of a digital infrastructure for medical research and USD 64 million in research and development and the technology sector. The rest of the budget is reserved for regulation of the digital health sector by means of provisions, certificates and subsidies as well as academic scholarships.[135] This strategy is part of a larger plan for strengthening the Israeli digital health industry and enabling startups to pilot new technologies in direct collaboration with the HMOs.[136]

Implementation plans for basic digital health applications (EHR, ePrescription, etc.) are no longer required at the HMO level, as these technologies have been in place for over a decade, in some cases expanded, but largely deployed nationwide. In the past, HMOs have developed their own electronic health record and ePrescription services, implemented according to their own internal schedules, with neither influence nor oversight from the Health Ministry.

Cooperation between HMOs and representatives of the high-tech industry is now routine, especially in the research field; the state digital health plan brings a third actor to this arrangement, one that primarily inhabits a managerial and regulatory role.

133 However, intensive developments and activities have been apparent in the last three years.
134 Ministry for Social Equality, (2017). The Digital Israel National Initiative: The National Digital Program of the Government of Israel. Tel Aviv.
135 Krupsky, p. (2018). Israel Approves $264 Million National Digital Health Program. Available at: https://www.calcalistech.com/ctech/articles/0,7340,L-3734832,00.html.
136 Ministry of Health, (2018). *Creating a Healthy Future.*

Institutional anchoring, financing and legal framework

The Ministry of Health issues each of the HMOs with a proportion of the population's overall health expenditure relative to its membership base, while also stipulating the percentage of the annual budget that it must invest in research and development. These funds are earmarked, and represent a stimulus for constant competition, even between the four HMOs.

There is no dedicated state oversight of the quality and security of the digital health services offered. However, each HMO is itself responsible for safeguarding measures and may lawfully be sued in the event of infringement of data protection or patient rights. Within the Ministry of Health, the "Digital Health and Computerization" division is responsible for providing technical infrastructure, supporting organizations in their communications and anything else that surpasses the capabilities of an individual HMO. The Health Ministry promotes and finances the expansion of the HMO-based health information network at the national level – to enable data exchange between the different hospitals and outpatient physicians of all the insurers, for instance. In recent years there has been a clear institutional transformation, with the Health Ministry now increasingly acting as a national coordinator in those areas for which the HMOs do not assume responsibility, such as supporting communications between external hospitals and their own outpatient physicians.

The four HMOs are subject to regular evaluations with regard to the availability and quality of their services. All organizations voluntarily take part in the program under scientific guidance and with subsidies from the Health Ministry and are collectively able to influence the execution and prioritization of evaluations. In the legislative arena, specific laws related to digital data exchange and processing have only been passed over the last ten years following requests from the healthcare organizations. Previously there was no legislative framework in this regard, with participants instead adhering to internal organizational provisions. And there is still no legislative framework relating to the area of medical liability in cases of malpractice in the context of medical products and EHRs.[137]

There are highly specific regulations governing the use of data for research purposes, particularly with regard to shared usage of data beyond organizational confines. Israel's situation ensures that training in usage of digital healthcare applications is a fundamental component of vocational training for all new employees as soon as they begin work. All employees are obliged to learn how their healthcare facility's digital system or organization functions. Because these systems are constantly being updated, regular further training programs are required.

3.8.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Israeli citizens have a single identification document which is used for a huge variety of civic functions, including the healthcare sector and health insurance. This identity card is also used for authentication of medical professionals, in which case it is linked to their professional license number. When citizens join one of the HMOs, they sign a declaration

137 These can include: misdiagnoses, treatment errors, documentation errors, insufficiently informing patients, and mistakes relating to the division of labor between different physicians.

of consent for their health data to be exchanged with other organizations – however, consent may also be withheld, in which case only physicians within the member's own HMO have access to the data.[138]

Data exchange between organizations is subject to provisions issued by the Ministry of Health, which mandate high standards of encryption and data protection. For internal usage, on the other hand, HMOs define their own security measures. To guarantee interoperability between the organizations, the Ministry of Health is formally responsible for the introduction of ICT standards. A list of terminological and technical exchange standards has been published to facilitate reading and exchange of different electronic health records between the different HMOs, although it will only become mandatory in the future.

Digital health applications and services

Each HMO has established its own ePrescription service. Under this system the general practitioner can send the prescription to the pharmacist, who can then in turn confirm to the physician that the medication has been dispensed. Telemedicine services are primarily used in the area of teleradiology.

Almost every hospital in Israel offers its patients an internet link to their test results, which can be shared with their general practitioner and is thereby available throughout the HMO. A pilot project is currently being carried out with the goal of enabling patients to book doctor's appointments anywhere in Israel via a portal. Some HMOs have already introduced this.[139] Patients can also use the portal to gain quality-assured health and illness information from their own healthcare organization. Patients additionally have online access to any information available within the HMO. This means that they can request changes to their EHR. In each HMO this request goes to a committee which is entrusted with the responsibility and authority to change medical records, which will usually only comply with the request if the data is genuinely incorrect. Patients cannot make their own corrections to EHRs; even physicians are unable to make changes once they have entered data and closed the record on their PC.

There is only isolated use of mobile applications for monitoring patients, and there is no regulatory framework for mHealth within the HMOs. Patients can nonetheless access the patient portal through their mobile devices, retrieve their EHRs and communicate with physicians through an internal mail server. Standardization efforts are currently still in the planning phase but are being pushed by the Ministry of Health.

Data integration and exchange readiness

For HMOs to bill the Ministry of Health for their services, special documentation and coding requirements have been established that are mandatory for all HMOs. While there are a number of other standards that are used internal HMO documents or for other data registries (e.g., breast cancer registry, diabetes registry, etc.), the proportion of documented clinical notes in electronic health records created using standardized specifications is still over 75 percent.[140] Over 75 percent of available datasets are used for monitoring and evaluating healthcare.

138 Sources: national correspondent and survey results.
139 Sources: national correspondent and survey results.
140 Sources: national correspondent and survey results.

Hospitals are obliged to report to the Ministry of Health on their patient-related activities. Every day HMOs update their databases with information on patients with infectious diseases, diabetes and cancer. This data is evaluated by a committee and published on the internet. In this way the entire population is captured by the different databases. Because all patients can access their EHRs via the internet, this can be sent to a physician in PDF form when abroad. Therefore, there is currently no controlled flow of health data to other countries.

3.8.5 Actual use of data

A full 100 percent of physicians who work with the HMOs use EHRs to document patient data. Similarly, all pharmacies that are contractually bound to an HMO are linked to the national ePrescription server, so that every patient can present their prescription to any pharmacy in Israel that works with their own HMO. Paper prescriptions are generally not used any more. Hospitals are not linked to this system and generally do not prescribe medication themselves, rather they recommend appropriate medication to the patient's physician, who can then issue an ePrescription.

Telemedicine services are only offered by around 50-75 percent of all general practitioners and hospitals. The outpatient and inpatient sectors[141] are 100 percent linked to the relevant electronic health records of the HMO.[142] Hospitals use their own electronic clinical records which cannot communicate directly with the HMOs. The following information systems are also linked to the HMO's electronic health records:

- laboratory information systems
- medication information systems
- pathology information systems
- image archive and communications systems
- vaccination registry

The rate of exchange of patient data in the outpatient and inpatient sector is 100 percent.[143] Due to a lack of interoperability and a lack of will on the part of the HMOs to make improvements, fewer than 25 percent of all physicians can view patient data documented in hospitals. For the purposes of monitoring, analysis and improvement to the healthcare system, all patient data from the EHR and other datasets is processed by the Ministry of Health. As soon as this data is transferred out of an HMO to a third party, it is encrypted and anonymized.

The HMOs Maccabi and Clalit additionally operate multiple datasets for specific illnesses or patient groups for day-to-day health data exchange. These are transferred to national authorities, such as the Center for Disease Control, and ultimately feed into the national databases which also gather data directly from the smaller HMOs. At the national level there are ten such databases, which capture 26-75 percent of the Israeli population.[144] This data exchange from the different HMO sources does not occur automatically.

141 With the exception of hospitals. These are not available for inpatient care and are only responsible for highly specialized services.
142 Sources: national correspondent and survey results.
143 Data is not actively exchanged, rather automatically made visible to any physicians who are connected to the HMO's IT system, via the EHR.
144 Sources: national correspondent and survey results.

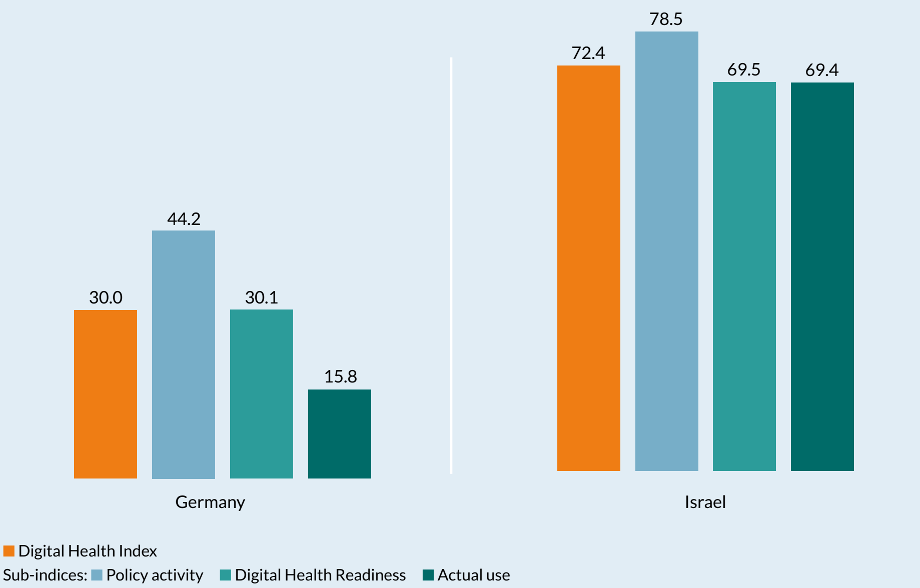
This data is periodically reported to national authorities according to very precise format requirements and must first be prepared. Within the HMOs there are random checks on the EHRs for quality and structure. Physicians are obliged to adhere to Ministry of Health requirements so that services rendered can be read and processed in billing documents.

Over 75 percent of the Israeli population has the option of retrieving their personal health data online. Around 50-75 percent used the information service to gain general quality-assured health information from the HMOs in 2017. On the other hand, only 25-50 percent of all patients visited the health information portal of their HMO. At least three out of four people undergoing acute treatment in this period accessed personalized information and documents in their EHR.[145]

3.8.6 Digital Health Index: Comparison with Germany

In assessing Israel's results for the indices examined by the study, the near identical scores for the sub-indices digital health readiness and actual use of data is striking. In comparison with Germany, the values for all areas are significantly higher in Israel and are overall more evenly distributed.

FIGURE 21: **Comparison between Germany and Israel,** in the Digital Health Index and sub-indices



Source: Bertelsmann Stiftung

145 Sources: national correspondent and survey results.

TABLE 14: **Digitalization profile Israel**

						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
		■			P2	Political will to support data transfer and data exchange is advanced
■					P3	An effective strategy to digitalise the healthcare system is in place
	■				P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
	■				P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
		■			P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
■					P7	A national digital health entity has been established for oversight of digital health implementation
■					P8	Digital health service refunding and financing is in place on the national / regional level
			■		P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
			■		P10	Legal frameworks in place to protect sharing of patient data
	■				P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
■					P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
■					T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
■					T2	Sufficient security actions are in place to secure patient privacy
			■		T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
■					T5	EPrescription services are operational
		■			T6	Telehealth and telemedicine can be routinely used
	■				T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
	■				T8	Patient control of content and access to the EHR
			■		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
	■				T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
		■			T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
■					T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
				■	T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
	■				A1	Digital health applications are a dominant solution for direct patient care
■					A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
		■			A3	Level of EHR uptake is high
		■			A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
	■				A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
	■				A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
■					A8	The quality of data and clinical content of electronic records being shared among providers is high
	■				A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung


Italy
60.58 million inhabitants
302,073 km² area
200.5 inhabitants per km²
Digital Health Index
Score: 55.8
Rank 12

3.9 Italy

3.9.1 The national healthcare system

Service provision

A major healthcare reform in 1978 transformed Italy's social security system – which at the time had around 100 different health insurance funds and a highly varied scope of services – into a centrally run state healthcare service. Further reforms in the 1990s and early 2000s decentralized this system once again. Since then the regions have been responsible for local healthcare provision, absorbing a large share of funding. The Health Ministry, which functions as a point of liaison and orientation, has the task of defining healthcare principles, framework conditions and a certain level of care for the regions. This includes guidelines and legislation regarding digital health. The regions are obliged to adhere to the ministry's defined guidelines and level of care. However, they are completely autonomous, free to organize and administer their own regional systems.[146]

Financing

Public financing accounts for some 78 percent of total health spending (as in 2011). Private health insurance accounts for less than 5 percent of total health spending. With health expenditure equivalent to 9.1 percent of GDP, Italy comes in at around the mid-point for Europe.

The public healthcare service is financed through national and regional taxes as well as supplementary payments by patients. Fiscal financing is raised through a regional production tax as well as a regional surcharge on income tax, allocations to the regions from national taxes, and through other regional and local taxes. The distribution of national funds is defined by national healthcare plans and is determined by the number of residents and the healthcare structure.

Care provision

Medical care takes place within a general practitioner system. General practitioners work in outpatient facilities, in health centers or independently. In the last case, they enter into contractual agreements with the authorities. Access to specialists falls within the remit of local health authorities or by referral. Within these areas, patients have free choice of specialists and hospitals. The regions and local health authorities are generally responsible for hospital care and their operation. Independent hospitals are bound to local health authorities and the state healthcare service through contracts. The number of hospital beds in Italy is 3.4 per 1,000 residents, well below the OECD average of 4.7 per 1,000.[147]

146 Di Minco, L. (2017). *Italian eHealth strategy implementation.*
147 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

3.9.2 Development of digital health

In Italy, a joint committee made up of representatives of the Health Ministry and the individual regions is responsible for the introduction and monitoring of electronic health-care services through the National Health Information Network (NSIS). The first step in this direction came in 2004 with the inception of a common digital health policy and corresponding definition of digital health architecture. After a 2008 government evaluation revealed major disparities in regional distribution of appointment booking systems and electronic health records, by 2012 a number of laws were passed and amended to introduce digital health services nationwide. Since 2015, for instance, every healthcare organization has to provide electronic health records that are configured according to certain national guidelines.

Since 2010 the law has regulated the electronic transmission of certificates of incapacity to the National Institute for Social Security and employers, for instance, as well as the use of ePrescriptions. Here there are two different infrastructures available: a national and a regional gateway. One major objective of the Italian digitalization strategy within the healthcare sector is to reduce paper documentation. Between 2008 and 2012, the ePrescription system was rolled out successively for each region, with the mandated maximum rate for hand-written prescriptions set at 10 percent of the amount issued in 2005.

Figure 22 summarizes existing digital health components in Italy identified in the course of this study (green-shaded fields).

FIGURE 22: **Map of digital health in Italy**

Digital Health Index

Score: 55.8

Enablers: strategies, standards, institutions

Legal framework conditions			Institutional anchoring	
Data protection regulations	Data security	Technical standards	National digital health agency	Financial ressources and incentives
Legal certainty	Medical terminology guidelines	Semantic standards	Enforcement of standards	Stakeholder engagement

Digital health infrastructure

Universal national patient identifier	Transparent national access regulations	Provider and service registers	Technical data infrastucture	Automatic retrieval of patient data

Digital health applications

Electronic Health Record (EHR)		Health services		Health information	Healthcare provision
Vaccinations	Medication list	EPrescription	Video consultations	Patient portal	Health system monitoring via EHR
Laboratory results	Patient access control	Online appointments		Health information portal	Health services research
Patient Summary	Structured and coded content	Telehealth			

■ available (two thirds of the questions answered positively)

Source: Bertelsmann Stiftung

3.9.3 Policy activity and strategy

Digital health strategies

Italy currently has an overall healthcare strategy in which the state of digitalization in the healthcare system is a key topic. Since 2008, digital health has been a focus for future developments in the country's healthcare sector and is listed as one of the priority areas of the national "Strategy for Digital Growth / Development 2014-2020." The healthcare system is established at various levels. The Ministry of Health is responsible for the development and implementation of new national strategies for healthcare, while direct service provision falls to the various regions. With respect to the differences between the regions, there is also a range in the scope of digital (health) services that have been made available in recent years. Of Italy's 20 regions, only five have not yet introduced centralized regions electronic health records.[148]

Services such as ePrescriptions, telemedicine and health information portals have been introduced as key focal points in the development of the digital healthcare system. They too fall under the responsibility of the regions but reflect the substance of the national digitalization strategy. A number of legislative guidelines have already been implemented in the area of digitalization; they serve to clarify general regulations for dealing with data and data exchange at the national level.

The process of implementing electronic services was carried out with public sector actors and in collaboration with representatives from the healthcare professions. The participation of private sector actors and the type of influence they exert differs from region to region.

Institutional anchoring, financing and legal framework

The implementation budget of the national digital health strategy is clearly defined. At the national level the Ministry of Health acts as a regulatory authority of mobile health apps. No standards for uniform terminologies or semantic standards have been developed or implemented. To date there are no guidelines related to innovation, research and performance evaluation of these applications, which may be defined as medical devices.

The Ministry of Health has general oversight over implementation of the national digital health strategy. Other authorities tasked with this are the Ministry of Economy and Finance and the Digital Italy Agency (AgID). In addition, the regions are themselves responsible for how they wish to implement parts of the digitalization strategy. They also act in an advisory capacity for new draft legislation. To date there is no evaluation authority for digital health technologies.

In Italy there is a dedicated public budget for digital health that is available at the national, regional and local authority level. The regional healthcare systems are also meant to reimburse part of their budgets for certain digital health services.[149] The majority of healthcare service providers also use part of their operational budgets to finance their digital health activities.

148 fascicolosanitario.gov.it, (2018). *Agenzia per l'Italia Digitale: Fascicolo Sanitario Elettronico.* [online] Available at: https://www.fascicolosanitario.gov.it/fascicoli-regionali.

149 Istituto per la Vigilanza sulle Assicurazioni, (IVASS) (2016). *Analisi Trend Prodotti Assicurativi.* [pdf] Available at: https://www.ivass.it/consumatori/azioni-tutela/indagini-tematiche/documenti/digital_health_insurance.pdf.

State infrastructure funding for physicians and hospitals, as well as implementation plans intended to ensure that digital health technologies are introduced with technological uniformity and defined time frames, are defined by the state. In any case, there are no financial penalties or incentives for (non-)implementation of digital health services, and consequently little has actually been implemented in this area. By law, general practitioners must use electronic means for certain services, such as prescriptions and certificates, including certificates of incapacity. Where these services are not available electronically, physicians must pay penalties defined in service contracts of the healthcare service providers.

In recent years Italy has seen the introduction of legislation related to data protection, data storage and data transfer, and laws specifically relating to EHRs. In parallel with this, the country has put a great deal of effort into securing data protection and enabling transfer of health data between service providers. And this new legal situation makes explicit reference to the question of medical liability in cases of malpractice in the context of medical products and EHRs.[150] A 2010 law stipulates that paper prescriptions must be "dematerialized" in the future or issued in electronic form.[151]

According to legislation, the collection, processing and dissemination of patient data is permitted for statistical and research purposes. At the regional and national level, all healthcare service providers are obliged to retain statistical data for all reimbursed services. This information serves to improve healthcare administration and the quality of healthcare services. A small number of universities and medical colleges offer their students courses in using digital health technologies. Clinics and insurers tend to offer their personnel further training opportunities internally.

3.9.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Italy has the introduced electronic ID nationwide for all citizens. This electronic ID is used for all electronic services, including healthcare services. At the regional level, electronic identity cards have also been introduced for medical personnel. This ensures that only consulting personnel have access to a patient's electronic data. Most regions have established regional health registries. The SPID project currently under way focuses on bringing together all electronic services and identity registries that are currently offered at the regional and national level.[152] The objective of SPID is to enable usage of all electronic services via authentication with the electronic ID and offer Italian citizens nationwide access to their electronic data.

Patients can determine who can and cannot access their health data. Corresponding data protection regulations governing data and EHRs are in force in Italy. Various de-identification methods for maintaining privacy are in place to enable the further processing of all personal information. The data from EHRs is protected by encryption algorithms. International classifications and terminology guidelines are not mandatory in Italy. Medical infor-

150 These can include: misdiagnoses, treatment errors, documentation errors, insufficiently informing patients, and mistakes relating to the division of labor between different physicians.

151 Ministry of Health, (2011). *The national eHealth Information Strategy. National context, state of implementation and best practices.* [pdf] Rome. Available at: http://www.salute.gov.it/imgs/C_17_pubblicazioni_1653_allegato.pdf.

152 Spid.gov.it, (2018). SPID: Sistema Pubblico di Identità Digitale. [online] Available at: https://www.spid.gov.it/.

mation standards in the area of communications and data structure based on HL7 are being successively introduced in Italy and are already mandatory in some areas.

While development of Italy's digital health system is limited at the national level, it is well advanced in some regions. There are regional EHR systems that collect information on the health of patients – seven regions have implemented this, a further ten are still in the pilot phase and four regions do not yet have mature systems (as at 2017).[153] However, these EHRs are subject to regional limitations in terms of data exchange. Currently there are government efforts to merge the regional databases into one uniform national EHR.[154]

Digital health applications and services

Pharmacies generally use their own ePrescription system. Prescriptions can be electronically issued and transmitted to the pharmacist. In some regions, this service is linked with the electronic health record.

Deployment of telemedicine varies greatly throughout the country. Some regions, such as Lombardy, offer telemedicine services as part of the regional EHR. The objective of introducing telemedicine as an integral component of healthcare services is enshrined in the national digital health agenda. Current legislation allows general practitioners to treat their patients through telemedicine applications,[155] placing them on the same level as in-person consultation. Patients can use the publicly financed, regional health information portals to get information on health-related issues, view their medication and personal health data as well as information on the Italian healthcare system.

While in many cases patients have access to their personal data, they are not themselves authorized to change data that has been entered by medical professionals. However, they do have the option of requesting that their general practitioner rectify false information. Patients may only delete or amend data in their EHRs that they themselves have entered. Patients can consent to having their electronic data viewed by physicians – but only on an all-or-nothing basis. On having a blood test carried out, for instance, the patient is asked which group of persons should have access to the test results – the consulting general practitioner alone, other family members or all other physicians as well. Although there is a national digital health agenda, the various activities that it covers tend not to be carried out in a uniform manner, instead they take place at the regional level without national coordination.

Data integration and exchange readiness

The Health Ministry defines terminological standards for electronic data entry in EHRs, which in any case can only be used for statistical purposes. These standards do not necessarily form an interoperability framework between healthcare providers. There are no binding guidelines governing the way clinical data is documented. For this reason, the proportion of healthcare service providers that use uniform specialist terminological standards in routine care is less than 25 percent. The state of uniformity in specialist terminology for national health registries is similarly low.

153 Di Minco, L. (2017). *Italian eHealth Strategy Implementation.*
154 Information from the national correspond for Italy.
155 Ministero della Salute, (2018). *Telemedicina: Linee di indirizzo nazionali.* [pdf] Available at: http://www.salute.gov.it/imgs/C_17_pubblicazioni_2129_allegato.pdf.

None of the regional EHRs are linked to each other, or mutually compatible. More than 75 percent of nationwide health registries use the same electronic identification number for uniquely allocating medical services and data to patients. The proportion of electronic health records that are used for monitoring the healthcare system is less than 25 percent.

Italy cooperates with other countries in various international projects aimed at creating a technical and legislative framework for international health data transfer.

3.9.5 Actual use of data

The percentage of general practitioners who store medical data electronically slightly exceeds 75 percent. On the other hand, only around 50 percent-75 percent of specialists use electronic health records. Overall there is no functioning national health information exchange network. ePrescriptions are the most used digital healthcare service in Italy – over 75 percent of the outpatient sector is linked to a (regional) ePrescription system and over 90 percent of all prescriptions are electronic. Between 50 percent and 75 percent of hospitals are linked to regional EHR systems, but only a few use it actively in routine care.[156] The following information systems are also linked to the (regional) electronic health records of the healthcare providers:

- laboratory information systems
- medication information systems
- pathology information systems
- vaccination registry

Although there is greater use of EHR systems among general practitioners than any other medical professions or facilities, fewer than 50 percent of them really exchange patient information; in fact the rate of data exchange between general practitioners and specialists or between general practitioners and hospitals is less than 25 percent. However, this data is subject to a high degree of regional variance. The use of health information from electronic systems for statistical purposes and for health policy analysis is highly uncommon, but this varies from region to region.[157]

In Italy, over a dozen databases gather illness-specific information that is intended to reflect the state of the healthcare system and evaluate its performance. Less than 25 percent of health data is automatically transferred from EHR systems into other databases.[158] Only administrative data from the ePrescription systems is automatically transferred to national databases and – depending on the region – to electronic health records.

Less than 25 percent of all information that is documented in electronic databases is uniformly structured by physicians or conforms to national or international medical terminological standards.[159] Currently there are no electronic systems designed to monitor and improve the quality and uniformity of the gathered data.

At present, between 25 percent and 50 percent of the entire population has access to their personal health data, but only 25 percent use it. Figures for 2017 show that Italians are

156 Sources: national correspondent and survey results.
157 Sources: national correspondent and survey results.
158 Sources: national correspondent and survey results.
159 Sources: national correspondent and survey results.

TABLE 15: **Digitalization profile Italy**

						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
	■				P2	Political will to support data transfer and data exchange is advanced
		■			P3	An effective strategy to digitalise the healthcare system is in place
	■				P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
			■		P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
			■		P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
	■				P7	A national digital health entity has been established for oversight of digital health implementation
■					P8	Digital health service refunding and financing is in place on the national / regional level
	■				P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
	■				P10	Legal frameworks in place to protect sharing of patient data
■					P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
	■				T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
				■	T2	Sufficient security actions are in place to secure patient privacy
		■			T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
■					T5	EPrescription services are operational
			■		T6	Telehealth and telemedicine can be routinely used
			■		T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
			■		T8	Patient control of content and access to the EHR
			■		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
		■			T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
				■	T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
			■		T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
	■				T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
			■		A1	Digital health applications are a dominant solution for direct patient care
■					A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
		■			A3	Level of EHR uptake is high
				■	A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
				■	A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
	■				A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
				■	A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

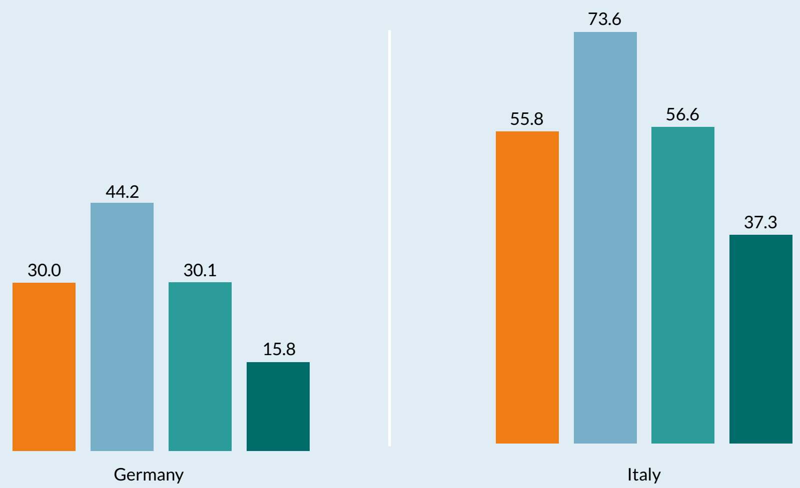
Source: Bertelsmann Stiftung

similarly disinclined to gain information on specific illnesses or complaints via health information portals.[160]

3.9.6 Digital Health Index: Comparison with Germany

A comparison of the percentage points for Italy and Germany in all of the indices captured in the study reveals a similar distribution in values. In each case the highest scores are for policy activity, with actual use of data coming last, while the Digital Health Index comes in around the middle, at the level of digital health readiness. The difference, however, lies in Italy's higher scores for all indices.

FIGURE 23: **Comparison between Germany and Italy,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity Digital Health Readiness Actual use
Source: Bertelsmann Stiftung

160 Sources: national correspondent and survey results.


Canada
36.50 million inhabitants
9,984,670 km² area
3.7 inhabitants per km²
Digital Health Index
Score: 74.7
Rank 2

3.10 Canada

3.10.1 The national healthcare system

Service provision

The Canadian healthcare system is based on a public service (Medicare) that is available to the entire population. The healthcare service is organized at the level of the provinces. Because of the decentralization and regionalization processes that took place between 1989 and 2005, responsibility now also rests with the regional health authorities in addition to the central bodies. The Canada Health Act (1984) also ensures that certain healthcare framework conditions apply in all provinces.

Financing

With annual healthcare expenses of USD 4,200 per capita, representing 10.1 percent of GDP (as at 2015), Canada ranks among the countries with higher-than-average healthcare expenses. In Canada, over USD 2,000 more than the OECD average is spent annually per capita on healthcare.

The financing of the public healthcare service takes place mainly through non-earmarked taxes at the federal and provincial level, amounting to around 70 percent of expenses. The central government makes a proportionate contribution to financing expenses, based on the population of the provinces. Private health insurance funds meet around 12 percent of healthcare expenses (as at 2012). Depending on the province, there may also be per-capita premiums, earmarked taxes, as well as employer contributions.

Care provision

Healthcare is primarily provided by private practices, with specialist care increasingly being administered in polyclinics and group practices. Patients are free to choose their general practitioner but require a referral to visit a specialist. Patients have freedom of choice between the hospitals in their province, which are usually publicly owned. In 2011, there were 2.8 hospital beds per 1,000 inhabitants, which is very low compared to the OECD average of 4.7.[161]

3.10.2 Development of digital health

Canada Health Infoway (Infoway) is a public, not-for-profit organization, which the government has allocated more than CAD 2 billion to date. It is tasked with promoting and accelerating the introduction of an interoperable electronic health record (EHR) in Canada. Infoway is directed by all deputy ministers of health of the provinces and territories, as well as by an independent board. The organization is attempting to accelerate the implementation of interoperable solutions through targeted investment programs for various functional aspects of an EHR.[162]

161 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

162 Lau, F., Price, M. and Bassi, J. (2014). *Toward a Coordinated Electronic Health Records (EHR) Strategy for Canada: White Paper – Working Draft.* Victoria: University of Victoria.

FIGURE 24: **Map of digital health in Canada**

Digital Health Index
Score: 74.7

Enablers: strategies, standards, institutions				
Legal framework conditions			Institutional anchoring	
Data protection regulations	Data security	Technical standards	National digital health agency	Financial ressources and incentives
Legal certainty	Medical terminology guidelines	Semantic standards	Enforcement of standards	Stakeholder engagement

Digital health infrastructure				
Universal national patient identifier	Transparent national access regulations	Provider and service registers	Technical data infrastucture	Automatic retrieval of patient data

Digital health applications					
Electronic Health Record (EHR)		Health services		Health information	Healthcare provision
Vaccinations	Medication list	EPrescription	Video consultations	Patient portal	Health system monitoring via EHR
Laboratory results	Patient access control	Online appointments		Health information portal	Health services research
Patient Summary	Structured and coded content	Telehealth			

available (two thirds of the questions answered positively)

Source: Bertelsmann Stiftung

Building on the digital health strategy of 2009, Vision 2015 was part roadmap and part investment plan for the period from 2010 to 2015. With the highest per capita budget for digital health worldwide, Infoway plans an interoperable EHR with diverse subsystems, such as a patient and professional staff register, an electronic medication system, registries for diagnostic imaging and laboratory results, and telemedical applications.[163, 164] The introduction of these systems takes places in a decentralized manner, which is why not all provinces are at the same level. Figure 24 summarizes the existing digital health components identified in Canada as part of this study (green-shaded fields).

3.10.3 Policy activity and strategy

Digital health strategies

Three strategic documents are largely responsible for digital health in Canada:

- *2015: Advancing the Next Generation of Health Care in Canada:*[165] an investment plan from the digital health authority Infoway, focused on the development of basic infrastructure, patient empowerment, health portals, and an interoperable HER.

163 Such as online appointment booking, video and email communication, and electronic discharge papers.
164 Canada Health Infoway, (2009). *2015: Advancing the Next Generation of Health Care in Canada.* Toronto: Canada Health Infoway.
165 Canada Health Infoway, (2009): *2015: Advancing the Next Generation of Health Care in Canada.* Toronto: Canada Health Infoway.

- *Opportunities for Action: A Pan-Canadian Digital Health Strategic Plan 2013:*[166] The primary focus here is on patient-centered care; this includes the development of digital services like ePrescriptions and eReferrals, the remote monitoring of chronic patients at home, and ensuring safe care by, for example, preventing incorrect prescriptions and side effects through the use of medication lists.
- *Digital Health Blueprint 2016:*[167] This supports the development of additional digital health applications and emphasizes the networking of existing services; it primarily represents an implementation tool for healthcare institutions, and highlights how new technologies can contribute to better healthcare.

In addition to these national strategy documents, the provinces are generally responsible for the design of healthcare provision, and cooperate closely with Infoway. The political will and commitment to digitalization is strong. This can be inferred from the scale of the investments and the far-reaching competencies granted to Infoway (see institutional anchoring below). Although Infoway determines the strategic focus of investments, final implementation takes place in the provinces, which have defined their own regional implementation strategies (e.g., Ontario and Alberta). In all regions, all central digital health services find their way onto the regional agenda, with the exception of mHealth.

As various private products are frequently implemented in the regions, Infoway greatly relies on the interoperability of all applications, which is defined and implemented in the form of standards in cooperation with economic stakeholders. In this process, the participation of the regional medical representatives is particularly important as these are the actual end users of the applications, and they accompany the development and implementation processes.[168] There are no legally prescribed frameworks or timeframes.

Institutional anchoring, financing and legal framework

Founded in 2001, Canada Health Infoway is a not-for-profit organization that invests public money in digital health projects in the regions. These projects can access the resources of Infoway investment programs by submitting project proposals, which are reviewed based on the program objectives and orientation of the current Infoway investment strategy. Following approval, Infoway finances up to 75 percent of the identified eligible costs, and the provinces have to finance the remainder. In addition, at project start, only 20 percent of the eligible funds are provided; the provinces have to provide the initial impetus for their projects. A further 30 percent of the funds are made available with the implementation of the approved project, and the remaining 50 percent are provided as soon as the previously defined implementation goals have been achieved. Between 2001 and 2013, a total of CAD 2.1 billion was invested by Infoway.[169] The economic impacts of digital health applications are measured within the framework of various evaluation programs.

Canadian health insurance funds have, in part, started to process claims for and promote digital healthcare services. In addition to the financing by Infoway, incentives for the introduction of certain applications are also set by regional governments. Many programs

166 Canada Health Infoway, (2013): *Opportunities for Action. A Pan-Canadian Digital Health Strategic Plan.* Toronto: Canada Health Infoway.
167 Canada Health Infoway, (2016): *Digital Health Blueprint. Enabling Coordinated & Collaborative Health Care.* Toronto: Canada Health Infoway.
168 Sources: national correspondent and survey results.
169 Canada Health Infoway, (2016): *Digital Health Blueprint. Enabling Coordinated & Collaborative Health Care.* Toronto: Canada Health Infoway.

provided for the introduction of certified applications so that particular costs in outpatient care could be billed.[170]

All important laws relating to the exchange of data, data security, and archiving are passed at the regional level. These laws explicitly refer to EHRs and digital healthcare services, and define medical liability with respect to medical errors.[171] Patients have the right to view their digitally stored health data.

The regional data protection authorities have arrived at a common basic consensus on the manner in which third parties may process health data, but this has been implemented to different extents in regional legislation. Strict data protection and processing provisions apply to public institutions, while the general health data law applies to private institutions.[172] A regional example of the strong anchoring of patient data rights is provided by the 2010 Excellent Care for All Act in Ontario.[173] Healthcare organizations are required to establish committees to internally monitor the quality of data security and of care, and clear responsibilities have been defined. In addition, data on patient satisfaction and experience within hospitals are collected and evaluated, and corresponding measures for their improvement are introduced.

3.10.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Most provinces possess an authentication system for physicians and patients, and have unique identification numbers. Healthcare professionals are recorded in a national database and are registered by the regions. In general, patients can view and determine which physicians have access to their EHR. However, this limit on access can be lifted in emergencies. Sensitive patient data are generally encrypted and de-identified prior to exchange. In order to train their staff in managing patient data, healthcare providers can avail themselves of regional training courses.

Various committees have been set up within Infoway, which, together with medical representatives and other stakeholders, establish semantic and technical standards, and promote the usage of common clinical terminologies in the regions. However, up to now, the latter have only been used for certain medical data.

Patient summaries and EHRs are used in all provinces to different degrees, but do not constitute a component of a national infrastructure. However, within the regions, there is well-developed automatic exchange of data between local databases, hospitals, and the regional EHR systems.[174]

170 Sources: national correspondent and survey results.
171 These can include: misdiagnoses, treatment errors, documentation errors, insufficiently informing patients, and mistakes relating to the division of labor between different physicians.
172 *Personal Health Information Protection Act 2004.*
173 Health.gov.on.ca, (2018). *Ontario Ministry of Health and Long-term Care: About the Excellent Care for All Act.* [online] Available at: http://www.health.gov.on.ca/en/pro/programs/ecfa/legislation/act.aspx.
174 Sources: national correspondent and survey results.

Digital health applications and services

Infoway cooperates with the provinces and private sector stakeholders in order to develop and finance the ePrescription service PrescribeIT in all provinces. This service allows physicians to send a prescription to a pharmacy that the patient has previously selected as a "favorite" in the system. All prescriptions are automatically sent to the PrescribeIT system if no favorite pharmacy has been selected. In this case, the patient can go to any participating pharmacy, which then accesses the ePrescription in the system and dispenses the medication. In 2017, over 3,400 pharmacies in six provinces took part in the program.[175]

Telemedical services are, to an extent, routinely used in the provinces. Legally, physicians are permitted to treat patients using remote diagnostics. Patients receive medical treatment from home mainly in remote regions. In 2011, around 7,000 patients took part in a Telehomecare program.[176] Throughout the country, the radiological departments in hospitals are nearly completely digitized, so physicians can exchange diagnostic results using secure electronic means of communication.

General information health portals are established across Canada. In many provinces, pilot projects are currently being conducted to provide patients with online access to their personal health information. These portals give access to regional EHRs, although patients cannot directly change their contents. In addition to administrative data, laboratory results, diagnoses, medication lists, and proof of vaccinations are also displayed. Patients can block other physicians' access to certain contents. Mobile health applications and devices are certified and monitored by the Canadian ministry of health. These are increasingly used in remote rural regions, as the closest hospital is often very far away, and simple diagnoses can often be made based on the data collected in this way. Critical conditions can also be predicted by means of remote monitoring, allowing timely admission to a hospital.

Data integration and exchange readiness

The implementation of defined common standards is made possible with the assistance of Infoway and regional authorities. The main focus here is on the interoperability of the individual regional systems and promoting the national exchange of data. At the same time, national institutions coordinate all activities in this area, and provide medical staff with information materials.

While semantic standards are mandatory, common terminology catalogues have been introduced primarily for databases and IT systems to monitor public health. Regional EHR systems and national databases that use medical data secondarily for research or evaluation purposes are, in general, completely interoperable, and access encrypted patient information using a unique identification number. Almost the entire population are recorded in regional EHR systems.[177] There is no regular exchange of data internationally. Patients are able to share access to their data with foreign institutions if, for example, they are admitted to hospital when on vacation abroad.

175 Canada Health Infoway, (2018). *PrescribeIT: Canada's Electronic Prescription Service.* [pdf] Toronto: Canada health Infoway. Available at: https://www.prescribeit.ca/component/edocman/140-prescribeit-backgrounder/view-document?Itemid=0.

176 Praxia Information Intelligence, and Gartner, Inc. (2011): *Telehealth Benefits and Adoption: Connecting People and Providers Across Canada.* [pdf] Toronto: Canada Health Infoway. Available at: https://livecare.ca/sites/default/files/telehealth_report_2010_en.pdf.

177 Canada Health Infoway, (2018): *Year in Review 2016-2017.* Toronto: Canada Health Infoway.

3.10.5 Actual use of data

More than 75 percent of outpatient physicians and specialists document patient data electronically. However, in 2017, still only 42 percent of outpatient physicians were connected to a regional EHR system, whereas over 75 percent of all hospitals and pharmacies have this access. In general, telemedical services are mainly provided by hospitals (>75 percent), only finding increased use with general practitioners in rural regions (<20 percent of all general practitioners in Canada use telemedical services). Although PrescribeIT has not yet been fully implemented, over 75 percent of prescriptions are electronically generated. However, the electronic transfer of these to pharmacies has taken place in only a small number of regions thus far. The national connection of outpatient care and pharmacies is only around 25 percent complete. In 2016, 61 percent of all pharmacies were connected to a regional pharmaceutical information system.[178]

TABLE 16: **Use of digital health applications by document type**

Documents exchanged*	general practitioners	specialists
Laboratory tests	65 %	39 %
Electronic discharge papers	65 %	45 %
Medication lists	80 %	56 %
Electronic referrals	58 %	28 %

* Canadian Medical Association, (CMA), (2017): CMA Workforce Survey 2017. National Results by FP/GP or Other Specialist, Gender, Age, and Province/Territory. [pdf] Ottawa: Canadian Medical Association. Available at: http://cma.andornot.com/SurveyPDF/CMA_Survey_Workforce2017_Q23_ElectronicToolsUsed-e.pdf.
Source: Bertelsmann Stiftung

Regional EHR systems are generally connected to the following databases:

- laboratory information systems
- medication information systems
- image archive and communications systems

Between 50 and 75 percent of physicians across all healthcare sectors regularly exchange data with each other, with GPs in medical practice exchanging / accessing more data than specialists on average:

At the national level, over ten databases use information from regional EHRs in order to contribute to improving public healthcare provision. However, data from regional systems are not automatically transferred. The following datasets are nationally available:

- inpatient psychiatric data
- data from outpatient care
- cancer registry data
- official long-term care data
- data from population health surveys
- census and registry data

178 Gartner, Inc. (2018). *Connected Health Information in Canada: A Benefits Evaluation Study.* [pdf] Toronto: Canada Health Infoway. Available at: https://www.infoway-inforoute.ca/en/component/edocman/3510-connected-health-information-in-canada-a-benefits-evaluation-study/view-document?Itemid=101.

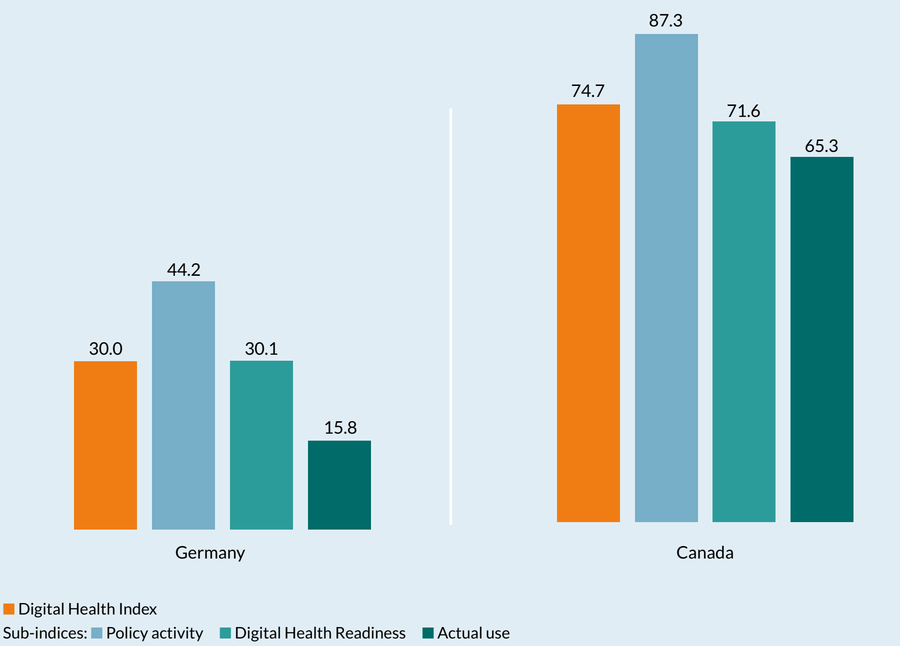
The standardization and implementation of common terminological guidelines for the documentation of patient data is an ongoing process being driven by Infoway. Neverthe-less, the proportion of physicians documenting clinical data based on common guidelines is as low as under 25 percent. The data quality and significance of certain types of data in regional EHR systems are reviewed by random sampling. However, this is a patchy process, and is not conducted by all regions.[179]

Around 50 percent to 75 percent of Canadians are able to view personal health information using an online portal. As there have been no associated public information campaigns, some patients do not even know of the opportunities of the digital healthcare system. Health portals that offer quality-assured information on diseases in general were viewed by 50 percent to 75 percent of the population in 2017.[180]

3.10.6 Digital Health Index: Comparison with Germany

The comparison between Canada and Germany demonstrates Canada's higher score not only in the Digital Health Index, but also in all three sub-indices. In addition, it can be seen in both countries that policy activity scores the highest and actual use of data scores the lowest.

FIGURE 25: **Comparison between Germany and Canada,** in the Digital Health Index and sub-indices



Source: Bertelsmann Stiftung

179 Sources: national correspondent and survey results.
180 Sources: national correspondent and survey results.

TABLE 17: **Digitalization profile Canada**

						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
	■				P2	Political will to support data transfer and data exchange is advanced
	■				P3	An effective strategy to digitalise the healthcare system is in place
			■		P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
■					P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
■					P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
	■				P7	A national digital health entity has been established for oversight of digital health implementation
■					P8	Digital health service refunding and financing is in place on the national / regional level
■					P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
	■				P10	Legal frameworks in place to protect sharing of patient data
■					P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
	■				P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
	■				T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
■					T2	Sufficient security actions are in place to secure patient privacy
		■			T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
	■				T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
■					T5	EPrescription services are operational
		■			T6	Telehealth and telemedicine can be routinely used
			■		T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
			■		T8	Patient control of content and access to the EHR
			■		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
■					T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
	■				T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
	■				T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
		■			T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
	■				A1	Digital health applications are a dominant solution for direct patient care
		■			A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
		■			A3	Level of EHR uptake is high
		■			A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
	■				A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
■					A6	For monitoring and improvement of healthcare systems health data is used regularly
			■		A7	Automatic extraction of health data from EHR systems to national databases is pervasive
		■			A8	The quality of data and clinical content of electronic records being shared among providers is high
			■		A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung


NHS England
55.26 million inhabitants
130,395 km² area
423.8 inhabitants per km²
Digital Health Index
Score: 70.0
Rank 6

3.11 NHS England

3.11.1 The national healthcare system (United Kingdom)

Service provision

The United Kingdom, which introduced the National Health Service (NHS) as early as 1946, is a pioneer in providing public healthcare. The NHS is managed separately for England, Northern Ireland, Scotland and Wales. Since 2006 in England, healthcare provision has been overseen by 10 (previously 28) Strategic Health Authorities (SHAs), and on-site care has also been provided by 151 (previously 303) local healthcare services (Primary Care Trusts – PCTs), each of which bears responsibility for 340,000 people (on average). With their allocated budgets, the PCTs contract service providers in organizing and financing outpatient and inpatient care. In addition to NHS, private health insurance is available and offers more immediate access to medical treatment, a higher level of comfort and a broader selection of service providers.

NHS medical services, which are available free of charge to the entire population, are provided in line with the principle of benefits-in-kind. In relative terms, the services offered are comprehensive. While this catalogue of services is in principle available to everyone, the NHS is not able to provide these services always and everywhere. The provision of services depends on budget availability, service constraints or waiting lists, which may vary regionally. Waiting lists are often the result of insufficient funding or treatment capacities that prevail in some regions. Patients suffering from non-life-threatening conditions – rather than those suffering from an acute condition or requiring emergency treatment – are most affected here.

Financing

Just under 10 percent of GDP spending in the UK is on healthcare. This share rose from 6.6 percent in the mid-1990s to 9.4 percent in 2014, an increase that reflects the growth in health spending. In 2011, approximately $3,400 per capita was spent on health, which is slightly more than the OECD average of $3,339. Nearly 83 percent of NHS funding derives from tax revenues with social security contributions accounting for smaller amounts (the National Insurance Fund). These funds are then distributed via the SHAs and PCTs.

Care provision

Care is provided by GPs who are either employed by or contractually bound to the respective PCT. Patients are free to choose their physician, but he or she must also consent to the decision. If no physician agrees to undertake a specific treatment, the PCT can place the patient on a relevant practice's treatment. A specialist can be consulted only following a referral by a general practitioner. Patients with private insurance, on the other hand, have direct access to specialists. Specialist and inpatient care are provided predominantly by public clinics under the administrative responsibility of the NHS. Today, the majority of public hospitals are organized as trusts (NHS Hospital Trusts and NHS

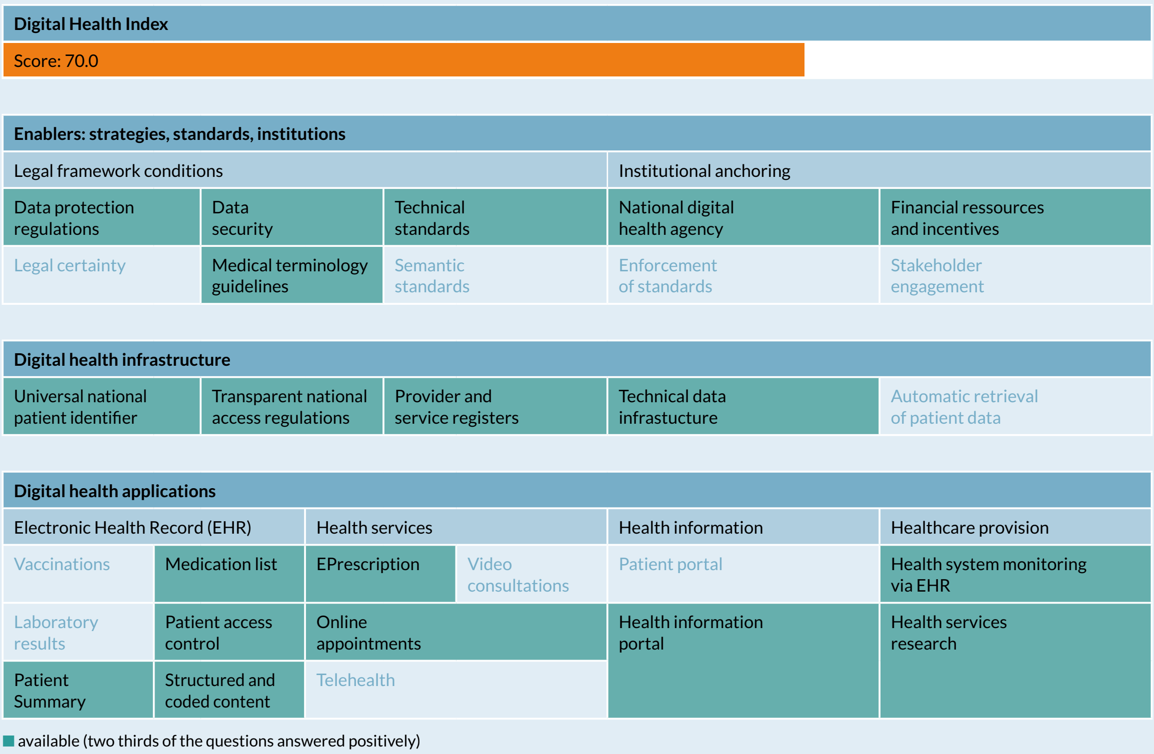
Foundation Trusts).[181] Freedom of choice in terms of selecting a hospital is somewhat limited; in general, the GP will recommend hospital appropriate to the patient's needs.[182]

3.11.2 Development of digital health (NHS England)

Thanks to NHS England's organizational hierarchy, the allocation of responsibilities within the organization and the considerable independence of the individual PCTs, each trust is more or less free to determine which digital health applications to use for their services. The NHS provides a range of certified, standardized products for various services and also defines the framework that enables these products to communicate with one another, when necessary.

In 2005, a National Programme for Information Technology (NPfIT), headed by NHS Connecting for Health, was initiated in 2005 in an effort to create a joint, centralized electronic health record. The size and complexity of the program was stupendous. Initially estimated to cost £12.7 billion over 10 years, the initiative has now become the largest civilian and non-military information technology project ever undertaken. Despite early signs that the project was destined to fail, enormous sums of money and time were none-

FIGURE 26: **Map of digital health in NHS England**



Source: Bertelsmann Stiftung

181 A National Health Service Trust is an organization within the English NHS that generally serves either a geographical area or a specialist function (e.g., an outpatient service). In some locations, several trusts can be involved in various services provided by local practitioners.

182 Schölkopf, M., and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2te Aufl. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

theless invested. Bearing this failure in mind, the NHS has increased its reliance on open community platforms such as open EHR.

The 2010 change in government resulted in the NHS being subject to a review that has had a significant influence on digital health policy. The National Programme for Information Technology (NPfIT) was formally rejected at the end of 2011 in favor of locally developed electronic clinical records systems. However, notable progress has been achieved with other national projects, such as the secure "N3" national network infrastructure, an image archiving and communication system, the "Choose and Book" electronic booking software application, the NHS Electronic Prescription Service, and the Summary Care Record. To date, there are no integrated implementation plans, only broad strategies targeting objectives relevant to the healthcare system. These strategies allow the PCTs to choose their own path in achieving these goals.

Figure 26 summarizes existing digital health components identified in the course of this study (green-shaded fields).

3.11.3 Policy activity and strategy

Digital health strategies

NHS objectives and measures are reformulated periodically every five years. The current healthcare strategy is presented in the *Five Year Forward View.*[183] The *Personalised Health and Care* 2020: *A Framework for Action*[184] (henceforth *Framework*) identifies barriers to the efficient integration of ICT in healthcare to date, as well as those measures that could make a difference in this regard. A crucial problem here involves the lack of interoperability between the various systems, which itself can be attributed to the absence of commitment among stakeholders and their failure to institute a centralized approach.

Electronic health records, ePrescription services, telemedicine (in particular video chat and online applications for home care) and big data are all addressed by NHS England's two key documents. The early recognition of the benefits of health apps for mobile devices and the desire to deliver innovative, cost-effective solutions from outside of the NHS (i.e., independent vendors) has had a profound influence on policy in this area. In accordance with the application programming interface (API)[185] approach for software, NHS England encourages developers to submit health apps for evaluation by the National Health Service and, where necessary, for approval by the relevant supervisory authorities. Already up and running, the health portal NHS Choices will be extended and adapted on an ongoing basis.

Thanks in part to *The Forward View into Action: Paper-free at the Point of Care,* NHS now has a guide for local stakeholders aiming to integrate digital health measures into routine

183 NHS England, (2014). *Five Year Forward Look.*
184 National Information Board, (2014). Personalised Health and Care 2020: Using Data and Technology to Transform Outcomes for Patients and Citizens: A Framework for Action. [pdf] Available at: https://www.digitalhealth.net/includes/images/news0254/PDF/0172_NHS_England_NIB_Report_WITH_ADDITIONAL_MATERIAL_S8.pdf.
185 emishealth.com, (2018). *The implementation of Open APIs in the UK health system.* [online] Available at: https://www.emishealth.com/thinking/the-implementation-of-open-apis-in-the-uk-health-system/.

care.[186] Regional or nationally oriented plans but also local roadmaps – so-called *local sustainability and transformation plans* – can thus be implemented into regional measures in accordance with NHS strategies.[187]

Diverse stakeholders are involved in the development and design of digital health measures at the NHS. The NHS Confederation encompasses over 560 organizations that commission or provide NHS services.[188] The Clinical Digital Council comprises various representatives from the clinician profession and functions as a consultative body on matters relating to Digital Health Governance.[189] Patients' organizations are broadly represented in a range of NHS bodies that do not explicitly deal with digital health.[190]

Institutional anchoring, financing and legal framework

Digitalization is the responsibility of different institutions within the NHS. The Data Coordination Board is responsible for the implementation and certification of information standards.[191] The board is one part of NHS Digital, the national provider for NHS England. Responsibility for directing and monitoring investments in digital health activities rests with NHS Digital, in consultation with the National Information Board (NIB) and NHS England. NHS Digital provides patients with information about available services, planned projects and treatment options within the scope of the NHS Choices health portal. In addition, NHS Digital gathers data on multiple aspects regarding the operation of health and long-term care systems and prepares this data for various analyses.[192]

The NIB is an advisory body that consults with national health and long-term care organizations within the NHS, public-health bodies, representatives from science and medicine, social welfare and local government as well as independent representatives in developing strategic data and technology priorities.[193]

The portfolio for projects and measures under the *Framework* amounts to €4.6 billion. Financing for clinical and non-clinical infrastructure for the current period is secured above all through the *Framework.* The NHS Digital budget for the period 2017/18 amounted to €427.6 million, which included operating costs for NHS Digital services and applications.[194]

In its operating plans, NHS Digital defines the implementation objectives for all programs within the *Framework.* There are no financial sanctions or subsidies in connection with the

186 NHS England, (2016). *The Forward View Into Action: Paper – free at the Point of Care Guidance for Developing Local Digital Roadmaps.* [pdf] Available at: https://www.england.nhs.uk/digitaltechnology-old/wp-content/uploads/sites/31/2016/11/develp-ldrs-guid.pdf.

187 england.nhs.uk, (2018). *Local Digital Roadmaps.* [online] NHS England. Available at: https://www.england.nhs.uk/digitaltechnology/info-revolution/digital-roadmaps/.

188 nhsconfed.org, (2018). NHS Confederation homepage. [online] Available at: http://www.nhsconfed.org.

189 england.nhs.uk, (2018). *Blog: Raising the Standard in Digital Health.* [online] NHS England. Available at: https://www.england.nhs.uk/blog/raising-the-standard-in-digital-health/.

190 NHS England, (2017). *Framework for patient and public participation in specialised commissioning.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2017/01/specialised-participation-frmwrk.pdf.

191 digital.nhs.uk, (2018). *Information standards and data collections (including extractions).* [online] NHS England. Available at: https://digital.nhs.uk/data-and-information/information-standards/information-standards-and-data-collections-including-extractions.

192 NHS England, (2017). *Annual Report 2016/17.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2017/07/Annual-Report-Full_201617.pdf.

193 gov.uk, (2018). *National Information Board: About.* [online] Available at: https://www.gov.uk/government/organisations/national-information-board/about

194 NHS England, (2017). *NHS Digital Business Plan 2017/18.*

NHS Digital implementation program. Because the government is the sole source of funding for NHS institutions, all financial penalties are paid out of the funds earmarked for general operations. If an NHS Trust or NHS Foundation Trust does not perform as expected in terms of quality of service or financial responsibility, NHS Improvement has the option to impose "special measures" on the Trust. This process involves the appointment of advisers or, in the worst case, a replacement of the trust management in order to resolve the issues.[195]

In addition to the EU's General Data Protection Regulation (GDPR), there is legislation specific to digital files in the NHS, but it remains unclear at this stage what adaptation these will require. The *Health and Social Care Act* from 2012 contains numerous references to quality of care, quality standards and the safety of provided services. Access to personal health data is legally protected only when it is in the form of traditional paper files, but not for digital files. Nevertheless, general practitioners can grant patients access, for example, to their Summary Care Record.[196]

NHS England also collects and processes data for statistical and research purposes.[197] Policies on data archiving, exchange, access and security are defined by NHS England.[198]

For several years, parts of the studies as well as training of medical professionals have covered digital applications and the proper handling of IT systems.[199]

3.11.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Unambiguous patient identification is not possible in NHS England at this time. However, pilot projects that foresee the use of the patient's NHS number as a unique identifier were launched in 2018. For health workers, the ID card is already used for these purposes within the NHS.

It is not generally possible for patients to determine which physicians are permitted to access their SCR. However, they can withdraw their agreement to the use of the SCR, requiring the file to be deleted outright.

General provisions for de-identification apply to selected datasets.[200] Training programs on handling health data are available for physicians.[201]

195 improvement.nhs.uk, (2018). *Guide to special measures.* [online] NHS Improvement. Available at: https://improvement.nhs.uk/resources/special-measures-guide-nhs-trusts-and-foundation-trusts/.
196 www.nhs.uk, (2018). *Your health and care records.* [online] NHS England. Available at: https://www.nhs.uk/NHSEngland/thenhs/records/healthrecords/Pages/what_to_do.aspx.
197 *Health and Social Care Act, 2012.*
198 NHS England, (2018). *Corporate Document and Records Management Policy.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2017/09/document-records-management-policy-v4.pdf.
199 england.nhs.uk, (2017). *News: NHS Digital launches e-nursing week campaign.* [online] NHS England. Available at: https://www.england.nhs.uk/2017/08/nhs-digital-launches-e-nursing-week-campaign/; and digital.nhs.uk, (2018). Nursing and NHS Digital [online] NHS England. Available from: https://digital.nhs.uk/about-nhs-digital/nursing-and-nhs-digital
200 NHS England, (2017). *De-Identification Data Items.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2017/04/data-sets-in-scope-scci2210.pdf.
201 skillsforhealth.org.uk, (2018). *Core Skills Frameworks.* [online] Skills for Health. Available at: http://www.skillsforhealth.org.uk/services/item/146-core-skills-training-framework.

The restructuring process in NHS England is ongoing, and a catalogue of consistent standards is set for publication later this year. Physicians are already required to use SNOMED CT as the classification standard for data documentation in all types of files.

The "Spine," an IT infrastructure that is maintained and developed by NHS Digital, connects much of NHS England's IT systems and enables the secure exchange of information and data, including the SCR, the ePrescription service and referral letters between individual trusts.

The SCR is a patient summary created automatically for patients once they have begun seeing a physician for treatment. The file is uploaded to the Spine and automatically updated whenever new information is added in the practice-based files. Using the patient's medical record as its basis, the SCR contains information about possible allergies, current prescriptions and administrative data. At the request of the patient, additional content and information (e.g., a serious condition) potentially relevant for multiple physicians can be added. In such cases since 2017, physicians have been required to discuss this disease-specific extension of the SCR with their patients and to obtain their consent.[202] If a physician wants to view a patient's SCR, they will need a health professional ID card to log in to the Spine.

Digital health applications and services

The ePrescription service enables prescriptions to be issued electronically and forwarded to a pharmacy, where the medicine is collected by the patient. An electronic confirmation of issuance is, however, not produced or filed in the system. Patients can use the service online via NHS Choices. A pharmacist can view a patient's SCR if they have the patient's consent.

Telemedical services are offered only infrequently by NHS England, and there is no single or uniform offer from the NHS in this regard.

The NHS Choices health portal aims to improve the health literacy of patients through a broad range of information on NHS operations and services, but also on diseases and treatments. The portal is currently undergoing restructuring and a range of projects are being tested, including a new appointment booking service designed to replace the "Choose and Book" booking software.[203]

Patients themselves have no electronic access to their SCR.

NHS Digital is initially looking into applications that will provide access upon approval. Future plans include establishing secure communication channels that will allow patients to contact their general practitioner via mobile devices.[204]

202 digital.nhs.uk, (2018). *Summary Care Records (SCR).* [online] NHS England. Available at: https://digital.nhs.uk/services/summary-care-records-scr.
203 nhs.uk, (2018). *Transforming Digital Health.* [online] NHS England. Available at: https://www.nhs.uk/transformation/.
204 NHS England, (2015). *Technology Enabled Care Services: Resource for Commissioners.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2014/12/TECS_FinalDraft_0901.pdf.

Data integration and exchange readiness

The majority of electronic systems in outpatient care are based on technical specifications that date back to the 1990s. These will need to be upgraded and adapted to modern standards to ensure the future interoperability of the different systems. This changeover has been underway since April 2018.[205] The SCR – running on the Spine – is based on its own unique standards and can be accessed from any medical practice. Before data can be transferred automatically from the practice-based electronic health record into the SCR, physicians in inpatient and outpatient care must adhere to the standards defined for the SCR.

Between 2008 and 2014, NHS England participated in the epSOS project, which was designed to prepare the agency for cross-border data exchange.[206] In general, English law on the EU-wide exchange of data is bound by the provisions of the GDPR.

3.11.5 Actual use of data

While the outpatient sector works entirely with digital files and is connected to the Spine,[207] a considerable share of hospitals still make use of paper files. A full 99 percent of all pharmacies and 90 percent of general practitioners offer the ePrescription service, which is used by 22 million people, with 1.7 million prescriptions issued daily.[208] The proportion of electronic prescriptions from all issued prescriptions is 60.9 percent.[209] Less than 25 percent of hospitals use the Summary Care Record.[210]

The GP2GP service enables GPs to submit (practice-based) electronic health records. This automatic process is initiated when a patient is electronically registered with a new doctor or practice that supports the GP2GP service. Some 99 percent of all surgeries in the outpatient sector are connected to the system, and more than 7.8 million files have been exchanged since 2007.[211] In contrast, there is almost no data exchange with specialists, most of whom work in hospitals.

Data from the SCR are processed and reused for research purposes and for the monitoring of the health system as a whole.

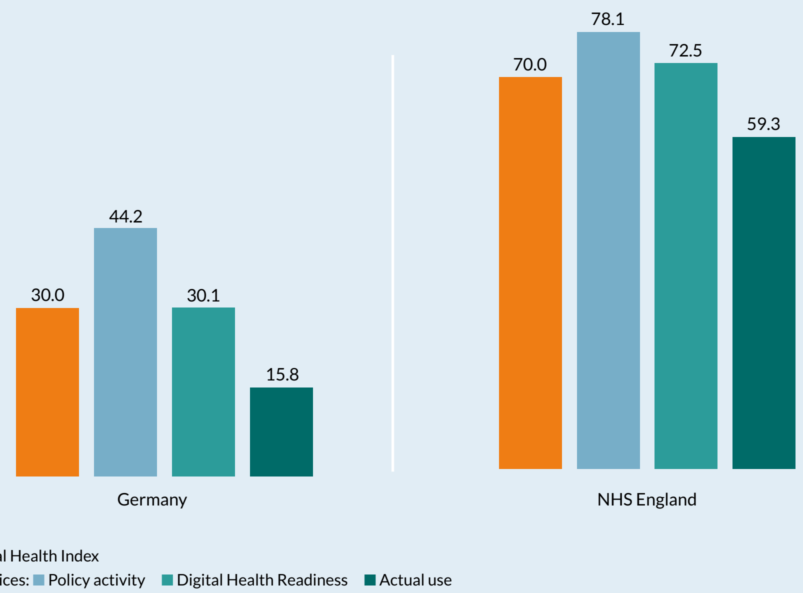
There is no ePA system in place in NHS England. Between physicians' practices and the SCR, automatic data exchange functions only for selected information types such as allergies and medications. The data stored in the SCR is periodically spot-checked and is inputted in accordance with uniform standards.

205 digital.nhs.uk, (2018). *SNOMED CT: Summary.* [online] NHS Digital. Available at: https://digital.nhs.uk/services/terminology-and-classifications/snomed-ct.
206 ec.europa.eu, (2012). *Digital Single Market: epSOS large scale pilot entering into operational mode!.* [online] European Commission. Available at: https://ec.europa.eu/digital-single-market/en/news/epsos-large-scale-pilot-entering-operational-mode.
207 digital.nhs.uk, (2018). *Summary Care Records (SCR).* [online] NHS Digital. Available at: https://digital.nhs.uk/services/summary-care-records-scr.
208 NHS England, (2017). *NHS Digital Business Plan 2017/18.*
209 digital.nhs.uk, (2018). *Deployment and utilisation progress data.* [online] NHS Digital. Available at: https://digital.nhs.uk/data-and-information/data-tools-and-services/tools-for-accessing-data/deployment-and-utilisation-progress-data.
210 Sources: National correspondent and results of the questionnaire.
211 digital.nhs.uk, (2018). *GP2GP.* [online] NHS Digital. Available at: https://digital.nhs.uk/services/gp2gp.

3.11.6 Digital Health Index: comparison with Germany

In a comparison of the percentages achieved by Germany and NHS England, there is a marked sloping off of actual data use in both countries as compared to other sub-indices. NHS England also scores higher than the German health system in all areas.

FIGURE 27: **Comparison between Germany and NHS England,** in the Digital Health Index and sub-indices



Source: Bertelsmann Stiftung

TABLE 18: **Digitalization profile NHS England**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
■					P2	Political will to support data transfer and data exchange is advanced
■					P3	An effective strategy to digitalise the healthcare system is in place
	■				P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
			■		P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
■					P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
	■				P7	A national digital health entity has been established for oversight of digital health implementation
	■				P8	Digital health service refunding and financing is in place on the national / regional level
		■			P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
			■		P10	Legal frameworks in place to protect sharing of patient data
■					P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
	■				T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
		■			T2	Sufficient security actions are in place to secure patient privacy
	■				T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
		■			T5	EPrescription services are operational
				■	T6	Telehealth and telemedicine can be routinely used
	■				T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
	■				T8	Patient control of content and access to the EHR
			■		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
■					T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
■					T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
■					T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
	■				T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
		■			A1	Digital health applications are a dominant solution for direct patient care
	■				A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
			■		A3	Level of EHR uptake is high
				■	A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
	■				A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
■					A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
■					A8	The quality of data and clinical content of electronic records being shared among providers is high
			■		A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung


Netherlands
17.02 million inhabitants
33,718 km² area
504.8 inhabitants per km²
Digital Health Index
Score: 66.1
Rank 9

3.12 Netherlands

The Netherlands is also included in the group of countries that will be the subject of a deeper analysis in Part II. The following consequently represents a digest of that analysis. This chapter is based on research and the results of the benchmarking questionnaire, while the more in-depth analysis of the Netherlands in Part II is comprised of additional study-related visits with further on-site interviews, which serve as a basis for the data and analysis, as described in the chapter describing the study's methodology.

3.12.1 The national healthcare system

Service provision

In 2015, the Dutch healthcare system accounted for 10.8 percent of total GDP. Since the reforms of 2006, there has been only one health insurance market (previously divided into social security and private insurance) with compulsory insurance for all citizens. As a result, patients can choose between the formerly statutory and private funds, and plans can be switched annually.

The level of service of the basic insurance that all Dutch citizens are required to obtain is identical for the nine existing providers. In addition, the providers are subject to government supervision and regulation, and there is an obligation to enter into a contract with all persons seeking insurance. Children under 18 are included in the insurance without an additional premium. 93 percent of the population have taken out additional optional insurance, in particular for dental treatment.

Financing

One-half of the health insurance is financed by means of a lump-sum premium, which is identical regardless of income within an insurance plan, but can nevertheless vary between insurance companies. The health costs for children and adolescents are borne by the government out of tax revenues. The lower the income of an individual, the higher the tax-funded health insurance subsidy that is granted to low earners by the tax authorities.

Care provision

The larger part of outpatient care in the Netherlands is overseen by the general practitioner system. Patients must choose a physician – typically in a private practice – who functions as a gatekeeper. Outpatient specialist care takes place in the hospitals, which are for the most non-commercial and managed by private trusts.[212]

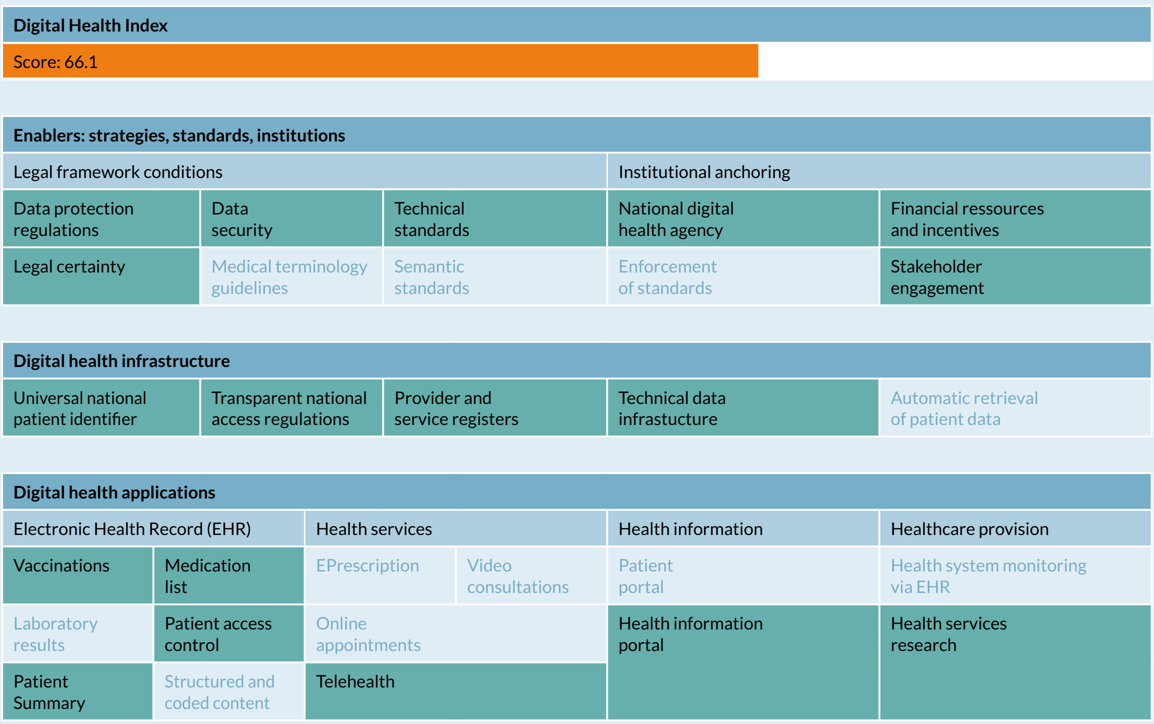
212 Schölkopf, M., und Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd edition. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

3.12.2 Development of digital health

In 2009, the Dutch government drafted a law that would see the Senate and House of Representatives to retroactively legitimize the 2008 introduction of an electronic patient record (Elektronisch Patiënten Dossier). However, this process was halted by the Senate in 2010 and ultimately rejected in 2011.[213] With this resolution, all government activities relating to the safekeeping and processing of personal health data had to be discontinued and privatized. The previously public infrastructure, AORTA, was restructured in order to prevent the exchange of data on a national basis and for the regionalization of such activities. In government circles, the hope was that this would improve security and privacy.

AORTA is the backbone of the Dutch health information system and was developed by the National IT Institute for Healthcare (NICTIZ) as part of a government contract. This infrastructure offers a national registration system for identification and authentication and as well as a reference index system called the National Switch Point (Landelijke schakelpunt, LSP). Since 2011, the regional exchange of medical data between healthcare service providers has taken place through the National Switch Point, which provides a reference index for routing, identification, authentication, authorization, and logging. The LSP is comparable to a traffic control tower, which regulates the exchange of patient data between service providers. Authorized service providers can view this data in order to gain a clear overview of a patient's medical history or current medication. In 2012, AORTA was re-launched by

FIGURE 28: **Map of digital health in the Netherlands**



■ available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

213 Netherlands Committee of Jurists for Human Rights, (2015). *Dutch Senate Skeptical of Electronic Health Records.* [online] Liberties. Available at https://www.liberties.eu/en/news/the-netherlands-electronic-health-records/3809.

a newly formed private organization that united the largest associations within the Dutch healthcare system. The Association of Healthcare Providers for Health Communication (Vereniging van Zorgaanbieders voor Zorgcommunicatie (VZVZ)) ensures the consistent operation of AORTA for its members (hospitals, practices, pharmacies, etc.) and encompasses over 80 percent of all healthcare service providers in the Netherlands.[214]

Figure 28 summarizes the existing digital health components identified in Australia as part of this study (green-shaded fields).

3.12.3 Policy activity and strategy

Digital health strategies

To date, the Netherlands has never pursued a standalone digital health strategy, as this is considered to be a part of the regular health care system. Rather, individual strategic documents form an overarching strategy (including the Medication Act, the Personal Data Protection Act, NICTIZ agenda on ICT in Healthcare 2008). Furthermore, there is no specific law regulating electronic health records, as this is addressed by other laws. The current trend in the digitalization of the healthcare sector is toward patient-oriented access to all health information.[215]

The diversity of Dutch approaches to digitalization is also reflected in the constellation of stakeholders. Few European countries have as many national and regional associations, interest groups and policymakers as does the Netherlands. Perhaps most notably, the country is known for its strong political commitment to and demand for viewing the patient as central to healthcare provision, as well as the stipulation that all technical developments be guided by this maxim. To this end, the development plans for electronic health records, patient portals, telemedicine and mHealth are geared toward giving the patient full control and insight into their data. The MedMij project promotes the development of a single personal patient record as the digital interface for all digital health services currently available in the Netherlands. Public stakeholders are generally involved in the development of digital health in the country through a variety of committees such as the National Health Information Council (Informatieberaad Zorg).

Institutional anchoring, financing and legal framework

NICTIZ is the government authority responsible for the development of information standards and exchange profiles in the health sector. Accordingly, there are provisions and interoperability plans for a range of applications, but mainly for regional data exchange. In the *eHealth Monitor,* NICTIZ gathers data on both the distribution of digital health information exchange as well as the level of satisfaction of medical professionals.[216] Digital health continues to be accompanied by the Health Information Council, which is primarily responsible for policy and legislation and is funded by the government. The Council for Public Health and Society (RVS) and the Rathenau Institute are involved in impact studies.

214 icthealth.nl, (2018). *Overheid stopt 3 miljoen euro in PGO voor elke Nederlander.* [online] ICT&Health. Available at: https://www.icthealth.nl/nieuws/overheid-stopt-3-miljoen-euro-in-pgo-voor-elke-nederlander/.
215 Sources: National correspondent and survey results.
216 Krijgsman, J., Zwinkels, I., van Lettow, B., de Jong, J., Out, K., Friele, R., and van Gennip, L. (2016). *English summary of eHealth monitor 2016, more than technology.* [pdf] Available at: https://www.nictiz.nl/wp-content/uploads/2018/04/ENG_infographic_eHealth-monitor_2016.pdf.

The funding system in the Netherlands is extremely complex. On the one hand, it is possible to obtain EU funds for national projects; on the other, both the state and private medical associations or patient organizations contribute to the financing and operation of existing digital applications as well as those that are still in development. For example, the VIPP program for accelerated data exchange between hospital physicians and patients is funded with €105 million from the Ministry of Health and is used for expanding infrastructure in Dutch hospitals.[217] If specific objectives are not achieved at the completion of the project, the recipient must pay back the full funding amount.[218]

Since the rejection of a national, government-run data-sharing infrastructure, the legislation has concentrated primarily on the regional exchange of health data. The most important laws dealing with digital health are the *Medical Treatment Contract Act, the Personal Data Protection Act and the Medication Act.* These determine the conditions under which a patient may be treated (also if there is no physical proximity between the attending medical professional and the patient), when a physician is legally liable for treatment errors, and how personal health data may be stored and/or exchanged between providers. At the national level, personal health data may be collected and use for statistical and research purposes.

3.12.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

The so-called BIG-Register identifies physicians, pharmacists and nurses. This BIG-ID for specialists is used as unique identification for the national register, namely the Dutch Unique Healthcare Provider Identification Register (UZI-register). The BIG-Register and UZI-Register are managed by the CIBG, an implementing agency of the Dutch Ministry of Health, Welfare and Sport. In the healthcare system, the citizen service number (BSN) is used to clearly identify patients. Both identifiers are valid in conjunction with a corresponding card, and were developed and introduced between 2000 and 2005.

Personal health data is generally de-identified before being shared with third parties and/or used for statistical purposes. NICTIZ is responsible for the introduction and promotion of medical IT standards. At present, a number of sectors are in a restructuring phase aimed at standardizing the various existing individual coding systems (SnomedCT). However, this process will be ongoing for some years. To date, coding and terminology standards have been compulsory in only a few areas; in most cases, they have become established for practical reasons or by custom.

More than 3,000 different regional and local electronic health records in the Netherlands are connected to the AORTA infrastructure. There is no national exchange and patient data is lost when the patient moves to another region. Between outpatient physicians, data is exchanged in the form of a patient summary, usually as an email attachment via AORTA.[219]

217 nvz-ziekenhuizen.nl, (2018). *VIPP-programma.* [online] NVZ. Available at: https://www.nvz-ziekenhuizen.nl/onderwerpen/vipp-programma
218 Sources: National correspondent and survey results.
219 Sources: National correspondent and survey results.

Digital health applications and services

A country-wide ePrescription service has been in a national pilot phase since 2016 and will be adopted nationally in the course of 2018.[220] Telemedicine services are firmly established in routine healthcare provision. Every hospital and medical practice maintains a portfolio of services and mobile applications (e.g., remote monitoring or teleradiology) for their patients, but there is no uniform framework.

For patients, the landscape of health information portals in the Netherlands is very confusing. Each individual healthcare facility operates their own portal, through which it is possible for patients to view entirely different data. The MedMij project is trying to reconcile this complicated landscape and to lay the groundwork for a central personal health portal for patients. A central access point for quality-assured and non-personalized health information is offered by the website Kiesbeter.nl. Patients can also have information changed through the various portals and means of online access if the physician agrees or the data is evidently entered incorrectly. Patients also have legally firmly established control through the more than 3,000 individual ePAs. mHealth or mobile applications are only offered locally by hospitals or outpatient physicians, and are not subject to a wider framework.

Network and data exchange readiness

As already mentioned, NICTIZ is responsible for defining and monitoring all standards for the inpatient and outpatient-care sector. The Zorginstituut Nederlands (ZN) is responsible for these functions in the area of long-term care (retirement homes, residential care, etc.). In turn, other organizations are responsible for specific sub-areas, such as the Dutch Pharmacy Association for standards relating to pharmacy systems.[221] As a result, there is no central authority for standards in the overall healthcare system. The last-mentioned association is also the most successful in terms of the standardization and promotion of its standards. Even in the outpatient area, there several coexistent sets of standards. In general, ePA systems are interoperable inasmuch as they are all connected to the LSP and AORTA; in some cases, however, they are coded very differently and the contents are semantically highly distinct. Also, no direct communication is possible between two different ePA systems.

To date, the Netherlands has not participated in international projects for personal health data exchange. Legally, it has hitherto only been possible to settle bills for medical services provided to Netherlanders abroad via the respective insurer in the Netherlands and the foreign provider.

3.12.5 Actual use of data

Physicians in medical practice document data 100 percent on an electronic basis, whereas this share is only between 50 and 75 percent among specialists. For the outpatient sector, the connection rate via AORTA is over 75 percent, both in pharmacies and within the sector. In inpatient care, however, only 50-75 percent of all physicians make active use of the health information infrastructure.[222] In general, only half of all general practitioners exchange health information with specialists and hospitals.

220 nictiz.nl, (2018). *Medicatieproces.* [online] Nictiz. Available at: https://www.nictiz.nl/programmas/medicatieproces/
221 Sources: National correspondent and survey results.
222 Sources: National correspondent and survey results.

In theory, it is permitted to share regular data from over 3,000 ePA systems with third parties for research purposes. In practice, however, the lack of uniform standards hinders the standardization and use of data from different sources that feature different documentation and coding systems.

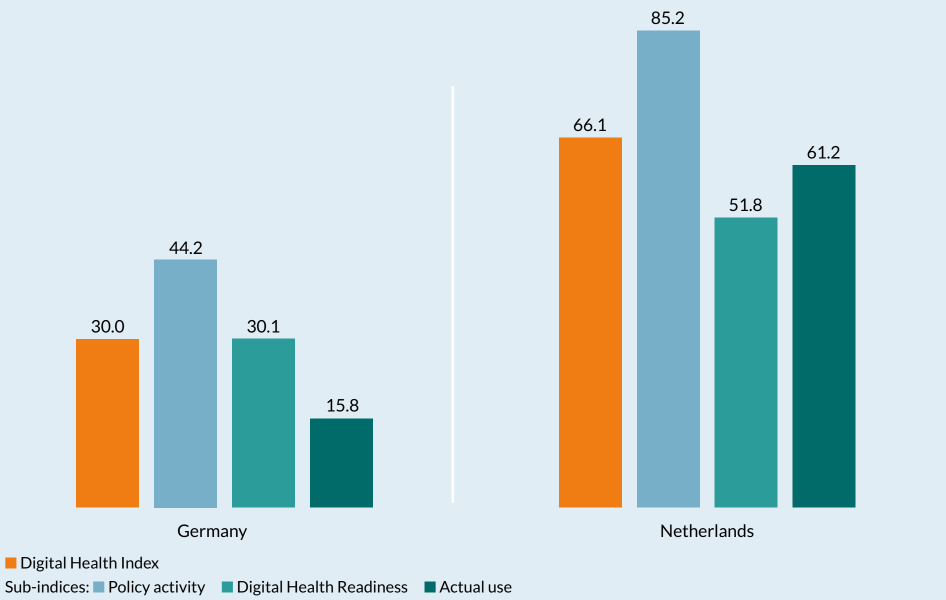
Monitoring reports on the observation of healthcare system organizational performance, which were conducted by a range of organizations, are based on numerous data registries that encompass all patients in the healthcare system. Less than 25 percent of the data from such registries have been automatically transferred from ePA systems, partly due to the lack of consistent data documentation that would be enabled by uniform terminology, and secondly due to a lack of national infrastructure.[223]

A large proportion of Dutch patients make use of the wide range of personal health portals and also inform themselves about medical conditions through the many private health information portals. In view of the number of competitors, the public portal Kiesbeter.nl is in no position to compete.[224]

3.12.6 Digital Health Index: comparison with Germany

Comparing the Netherlands and Germany as regards the relative evaluation of the Digital Health Index and the three sub-indices, the Kingdom of the Netherlands' higher performance is initially striking. It should also be emphasized that, in contrast to Germany, the level of actual data use is than that of Digital Health Readiness. In both countries, policy activity is ranked highest among all the indices.

FIGURE 29: **Comparison between Germany and the Netherlands,** in the Digital Health Index and sub-indices



Source: Bertelsmann Stiftung

223 Sources: National correspondent and survey results.
224 Sources: National correspondent and survey results.

TABLE 19: **Digitalization profile Netherlands**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
■					P2	Political will to support data transfer and data exchange is advanced
	■				P3	An effective strategy to digitalise the healthcare system is in place
	■				P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
		■			P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
		■			P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
	■				P7	A national digital health entity has been established for oversight of digital health implementation
■					P8	Digital health service refunding and financing is in place on the national / regional level
■					P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
■					P10	Legal frameworks in place to protect sharing of patient data
■					P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
	■				T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
■					T2	Sufficient security actions are in place to secure patient privacy
	■				T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
				■	T5	EPrescription services are operational
	■				T6	Telehealth and telemedicine can be routinely used
			■		T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
	■				T8	Patient control of content and access to the EHR
				■	T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
				■	T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
			■		T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
		■			T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
				■	T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
	■				A1	Digital health applications are a dominant solution for direct patient care
				■	A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
		■			A3	Level of EHR uptake is high
		■			A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
	■				A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
■					A6	For monitoring and improvement of healthcare systems health data is used regularly
		■			A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
	■				A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung


Austria
8.82 million inhabitants
83,878.99 km² area
105.2 inhabitants per km²
Digital Health Index
Score: 59.8
Rank 10

3.13 Austria

3.13.1 The national healthcare system

Service provision

Austria's current social security system covers almost the entire population. The country's 19 health insurance carriers are classified by federal state or occupational group (manual workers, salaried employees, self-employed, officials, farmers, railway workers, etc.).[225] It is not possible to freely choose between health insurance companies, as enrollment is based on status and place of residence. Employees, pensioners, students and unemployed persons are compulsorily insured; low earners can take out voluntary insurance, and free-lance professionals can be exempted from statutory compulsory insurance if otherwise demonstrably covered. Children, non-working spouses with childcare responsibilities as well as those in significant need of care are also co-insured without premiums.

Financing

With healthcare expenditure totaling 10.4 percent of GDP, Austria tops the list of the most expensive healthcare systems in a European comparison. The funding results from a pay-as-you-go system on a parity basis with income-related and centrally defined insurance premiums amounting to 10.25 percent (2017).

Care provision

The provision of services is guaranteed by the health insurance companies through contracts with service providers. Three-quarters of all physicians are in contractual relationships, although patients are nevertheless free to choose between them. However, if a so-called elective physician is consulted, health insurance companies will reimburse the patient to only 80 percent of the level that would be reimbursed for a contracted physician.

In Austria, responsibility for inpatient care is delegated to the federal states, including hospital planning, financing of investments and operational costs. There are church-based, public and private institutions, although most public hospitals in the individual states are subordinate to corresponding hospital associations, which receive public funding for the running of the hospitals from the applicable regional health funds.[226]

225 The incumbent governing coalition of ÖVP and FPÖ is planning to reduce the number of insurance carriers to five.

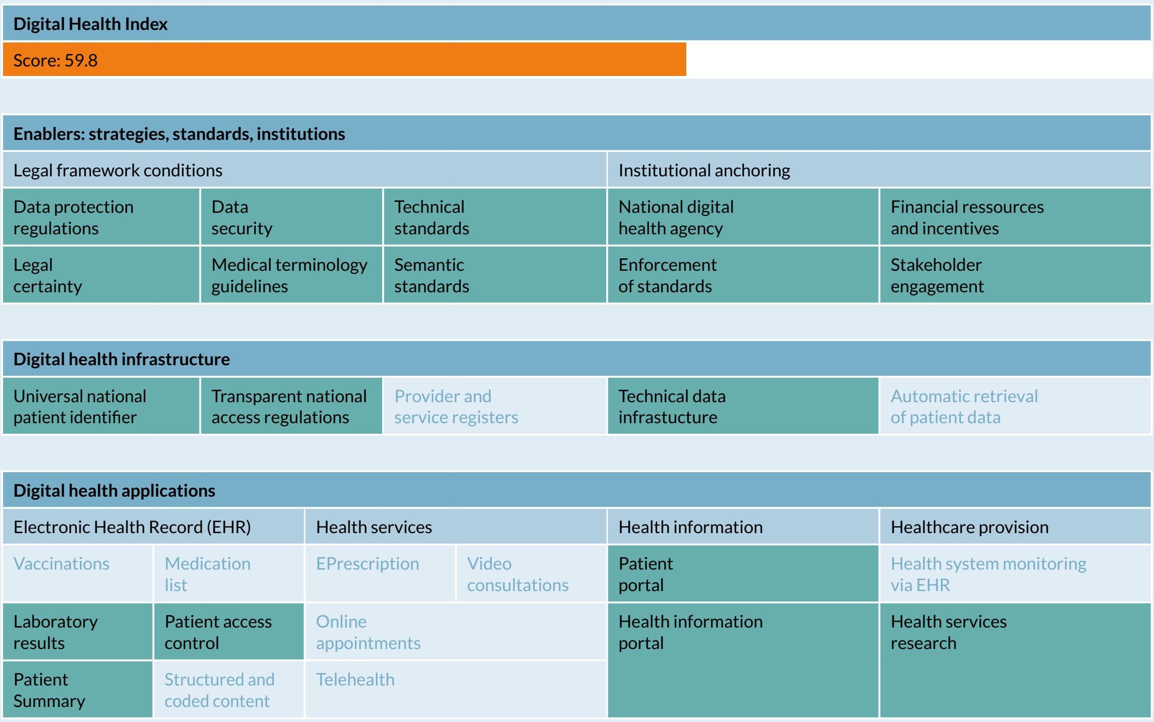
226 Schölkopf, M., und Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd edition. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

3.13.2 Development of digital health

Alongside the administrative streamlining brought about by the cashless utilization of healthcare services, the introduction of the electronic health insurance card (eCard) as far back as 2005 was an important foundation for the Electronic Health Record File Act (ELGA Act), which was passed in 2012. The coordination and integration of all operational measures for the introduction of the ELGA system as well as the construction of system components and the accompanying pilot projects all meet the requirements of the Federal Health Commission. The quality and acceptance management for the ELGA is under the authority of ELGA GmbH, which was founded in 2009 and is jointly owned by the federal government, the federal states and social security funds.[227] Alongside the health ministry as the preparatory jurisdictional body, ELGA GmbH is the most important institution in the field of digital health in Austria.

Further advances in the field of Austrian digital health are being made in the area of telehealth. As part of his responsibilities for digital health, the former health minister, Alois Stöger, gave increased attention to the topic of telemedicine, including the establishment of an interdisciplinary expert commission in March 2013.[228] This telehealth commission

FIGURE 30: **Map of digital health in Austria**



■ available (two thirds of the questions answered positively)

Source: Bertelsmann Stiftung

227 Elga.gv.at, (2018). *ELGA – Meine elektronische Gesundheitsakte.* [online] Available at: https://www.elga.gv.at/index.html.

228 Bmgf.gv.at, (2018). *E-Health/ELGA.* [online] Available at: https://www.bmgf.gv.at/home/Gesundheit/E-Health_Elga/Telemedizin/.

(TGDK) was principally tasked with delivering recommendations for the introduction of concrete telehealth services into regular healthcare delivery in Austria. Thereby, the primary focus was on application fields for the care of the chronically ill. The final report of the TGDK was submitted to the health minister in 2014.[229] The TGDK suggested that the use of telemonitoring should continue to be used in the treatment of diabetes mellitus, cardiac insufficiency, and possibly also implant aftercare. In May 2015, at the suggestion of then-Minister of Health Sabine Oberhauser, a project group was set up for further work. One significant outcome from the activity of this project group is the formulation of a catalogue with 14 recommendations intended to give direction to the continued development of telemonitoring in Austria. In addition to the recommendations, another important product is the IT architecture, which will serve as the basis for all future activities in Austria. The current assignment is the creation of a binding, concise set of guidelines that is intended to define the technical standards.[230]

Figure 30 summarizes the existing digital health components identified in Australia as part of this study (green-shaded fields).

3.13.3 Policy activity and strategy

Digital health strategies

The current health system strategy takes the form of 10 Health Targets for Austria, [231] whereby the field of digital health falls within the scope of Health Target 3, which is aimed at boosting the health literacy of the general public. Both the work on ELGA and the health portal gesundheit.gv.at, as well as general education campaigns, are defined as recommendations. To date, there is no successor to the eHealth Strategy from 2007.[232]

Government efforts to institute the digital sharing of health information as well as making this information available for patients is part of ELGA's responsibility. From the outset, the development of ELGA was shaped to a greater extent by political rather than technical concerns. This required adaptation to a range of laws, and extremely close attention was paid to the best means of safeguarding data protection aspects and patient privacy.

The ELGA initiative itself includes a number of other plans for the implementation of an ePrescription service, mHealth, telehealth and the networking of files with the health information portal gesundheit.gv.at. Overall, these efforts are intended to describe a vision of how the Austrian healthcare sector can be improved with the help of a fully functioning ELGA and how to strengthen the role of the patient. Chronological implementation plans for the individual functions of ELGA are specified by law. This will be the case from mid-

229 Federal Ministry for Health, (2014). *Recommendations and report of the telehealth commission to the Federal Minister of Health, in accordance with to §8 BMG.* Vienna.

230 Weik, I., und Sauermann, S. (2016). Telemonitoring in Österreich. *Zeitschrift für Gesundheitspolitik,* [online] 3, S. 36-46. Available at: http://docplayer.org/60451165-Telemonitoring-in-oesterreich.html.

231 Federal Ministry for Health and Women (2017): *Gesundheitsziele Österreich. Richtungsweisende Vorschläge für ein gesünderes Österreich – Langfassung.* Wien.

232 eHealth Initiative (2007): *Eine Kommunikations- und Informationsstrategie für ein modernes österreichisches Gesundheitswesen.*

2018 for eMedication, to be followed incrementally from 2019 by eVaccination record, eReferral,[233] eTransfer,[234] eDirective,[235] and the ePrescription.

ELGA GmbH is responsible for the implementation and coordination of the individual functions of ELGA, and is directly subordinate to the Ministry for Health. ELGA GmbH was founded in 2009 by the federal government, the federal states and social security funds. Since then, both patient associations and representatives of the medical profession have been involved in the process of developing ELGA. Economic stakeholders are included only in the final implementation of individual functions.

Institutional anchoring, financing and legal framework

In the past year, an annual budget was made available for the activities of ELGA GmbH, which must be distributed among the various projects. There is no superordinate center for clinical terminology and classifications; to this end, the ELGA initiative has established a series of standards for the Federal Health Commission.[236]

Public sector health apps in Austria are only available in the area of health information and are not regulated by any governmental supervisory body. In addition to the implementation of digital health applications, ELGA GmbH is also responsible for the evaluation of projects, the long-term impacts of digital health on the healthcare sector, and communication campaigns.

Public funding for the introduction and operation of digital health applications is regulated to the greatest possible extent; insurance companies spend part of their annual budget on reimbursement for new digital services with the aim of avoiding extra costs for patients. The use of specific terminology for the documentation of clinical data has been established for the entire ambulatory and inpatient healthcare sector. If a timeframe for the introduction of a new function within ELGA is not met, financial penalties are imposed on the respective providers.

The 2012 legislation for the Electronic Health Record File Act set nationwide minimum standards that have improved data security for the use of electronic personal health data. In addition, harmonized rules have been adopted with regard to user identification/authentication, access protocols, and data exchange and processing. Subject to high requirements, personal health data may be used for research purposes. In recent years, a number of educational institutions have also expanded their training opportunities to include digital health applications.

233 eReferral: If a doctor is unable to carry out a specific examination, e.g., an X-ray, they can assign the patient to a different doctor, who undertakes the service. Sources: hauptverband.at, (2018). *SV: Hauptverband der österreichischen Sozialversicherungsträger.* [online] Available at: http://www.hauptverband.at/cdscontent/?contentid=10007.789193.

234 eDirective: If a patient is assigned to a different doctor for a specific service, this is prescribed in the original practice using an electronic code. Sources: hauptverband.at, (2018). *SV: Hauptverband der österreichischen Sozialversicherungsträger.* [online] Available at: http://www.hauptverband.at/cdscontent/?contentid=10007.789193.

235 eReferral: the electronic transfer for further treatment. Usually to a specialist. Sources: hauptverband.at, (2018). *SV: Hauptverband der österreichischen Sozialversicherungsträger.* [online] Available at: http://www.hauptverband.at/cdscontent/?contentid=10007.789193.

236 Krüger-Brand, H. (2010). E-Health in Österreich: Pragmatischer Ansatz trägt Früchte. *Deutsches Ärzteblatt,* [online] Jg. 2010, Nr. 107(28-29). Available at: https://www.aerzteblatt.de/archiv/77592/E-Health-in-Oesterreich-Pragmatischer-Ansatz-traegt-Fruechte.

3.13.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

The central patient index and healthcare service provider index identify and authenticate the patient during the use of the electronic health card and in the subsequent access to the patient's ELGA. Thereby, a comparison is made as to which type of patient access can be obtained by which physician on ELGA, and the time, place and duration of access are automatically logged. Patients can decide autonomously whether specific content in their ELGA is visible or not to physicians.

The ELGA system itself is not a centralized storage location for health information, but retrieves contents on an individual basis from the various IT systems of hospitals or medical practices, and displays these online. To this end, special encryption algorithms and de-identification methods have been developed to protect the system against the misuse of data. International standards from the area of medical informatics as well as guidelines relating to clinical classifications and terminologies have been introduced at the national level.

Digital health applications and services

The ELGA system is the Austrian equivalent of an electronic patient record, and has been gradually introduced as an opt-out system since 2016. The first function to be used in all federal states are eDiagnostics, which include both discharge documents and diagnostic findings. These documents can be accessed via the portal gesundheit.gv.at; physician access can be locked or documents deleted altogether – the patient retains sovereignty over the available data. If a physician creates new information following a visit by a patient, the ELGA is updated automatically.

The other core applications will be implemented in the course of the next years, namely the eMedication (piloted regionally since 2017; national rollout from 2018), eLog and the eVaccination record. Using eMedication, the pharmacist can indicate in a medication list if and when a prescribed drug has been given to the patient. This is carried out using a code, which is initially provided to the patient by the physician. At the pharmacy, the patient inserts their electronic health insurance card into a reader and the list of medications is updated. If a physician wishes to access these in the patient's ELGA, they can view all of the necessary information about the current medication and identify any unwanted interactions.[237] Telemedicine services are only offered (if at all) on a local basis by individual physicians or hospitals.

The fundamental motivation behind the health information portal gesundheit.gv.at is the provision of quality-assured, objective and service-oriented health information within the scope of Health Target 3. It serves as the point of access for ELGA in Austria, provides an outline of health structures and presents health organizations. The main objective of the portal is to empower patients. At the present stage, however, it is for informational purposes only and is an initial simple service within the framework of ELGA.[238] The hospitals

237 hauptverband.at, (2018). *SV: Hauptverband der österreichischen Sozialversicherungsträger.* [online] Available at: http://www.hauptverband.at/cdscontent/?contentid=10007.789193.

238 Gesundheit.gv.at, (2018). *GESUNDheit.gv.at: Öffentliches Gesundheitsportal Österreichs.* [online] Available at: https://www.gesundheit.gv.at/elga/inhalt.

were the first to be equipped with ELGA; medical practices, care homes and pharmacies will be successively connected to the national infrastructure.[239]

There are no mobile health applications to date, but ELGA can nevertheless be accessed via the browser of a mobile device.

Data integration and exchange readiness

Even before the introduction of the ELGA system, ELGA GmbH undertook a technical and semantic standardization of a range of document types, and developed guidelines on how to retrofit existing information systems in medical practices and hospitals in order to safeguard the flow of information. A single mandatory code system was also introduced (Logical Observation Identifiers Names and Codes, LOINC). Over 75 percent of hospital physicians connected to ELGA already document clinical data in line with mandatory national standards and guidelines. Austria has not participated in international projects that enable the exchange of health information between countries. Legally, it has hitherto only been possible to settle bills for medical services provided to Austrian citizens abroad via the respective insurer in Austria and the foreign provider, as stipulated by EU legislation.

3.13.5 Actual use of data

At this time, no outpatient physicians or specialists are connected to ELGA, while 100 percent of hospitals and pharmacies are connected. Because ELGA is an opt-out system, files exist for the entire population, but this does not mean that every file automatically contains information. ePrescriptions are not yet being issued, and this service is set for development in the coming years. At present, only systems for diagnoses and discharge papers are able to communicate with ELGA.

Digital data exchange in Austria is currently limited to the hospitals, of which only less than 25 percent exchange data with one another; at the same time, the requirement for exchange between hospitals is not established. Data exchange with third parties for research purposes is only possible with the explicit consent of the patient. On the technical side, the data structure and composition of the ELGA system permits exportation in the form of data records. However, physicians must store reports or findings in ELGA; there is no automatic transfer.

There is no entity that verifies the data quality of the documents in ELGA. To date, however, the file contains little genuinely structured data, which is primarily due to very few potential uses. The national rollout will require several years to complete. Among the general public, there is limited knowledge of the health information portal gesundheit.gv.at. It is estimated that less than 25 percent of patients visited the portal in 2017 to seek information about their state of health. In the future, all citizens with an ELGA will be able to access their personal health information via the portal.

239 Elga.gv.at, (2018). *ELGA: Meine Elektronische Gesundheitsakte.* [online] Available at: https://www.elga.gv.at/faq/technische-bausteine-von-elga/index.html.

TABLE 20: **Digitalization profile Austria**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
■					P2	Political will to support data transfer and data exchange is advanced
		■			P3	An effective strategy to digitalise the healthcare system is in place
		■			P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
	■				P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
			■		P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
	■				P7	A national digital health entity has been established for oversight of digital health implementation
	■				P8	Digital health service refunding and financing is in place on the national / regional level
	■				P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
	■				P10	Legal frameworks in place to protect sharing of patient data
■					P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
	■				T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
				■	T2	Sufficient security actions are in place to secure patient privacy
		■			T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
				■	T5	EPrescription services are operational
				■	T6	Telehealth and telemedicine can be routinely used
		■			T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
	■				T8	Patient control of content and access to the EHR
			■		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
	■				T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
	■				T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
	■				T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
		■			T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
		■			A1	Digital health applications are a dominant solution for direct patient care
				■	A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
			■		A3	Level of EHR uptake is high
			■		A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
	■				A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
	■				A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
			■		A8	The quality of data and clinical content of electronic records being shared among providers is high
			■		A9	Patient portals offering access to personal healthcare information are highly frequented

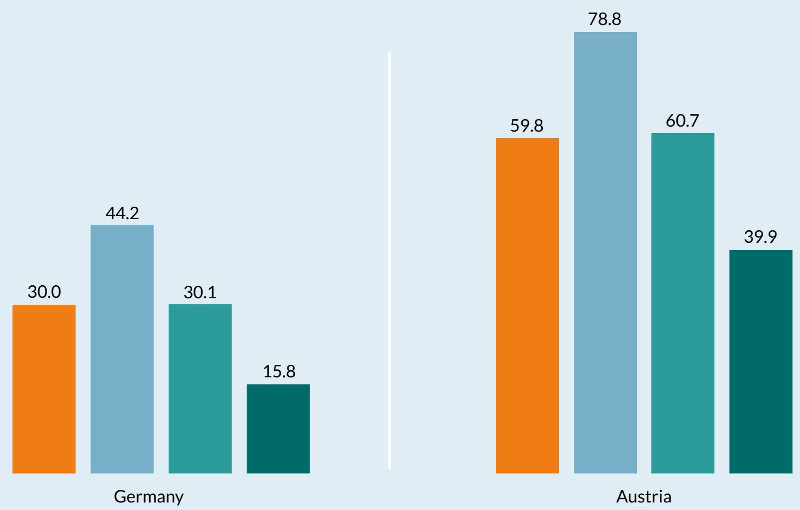
■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung

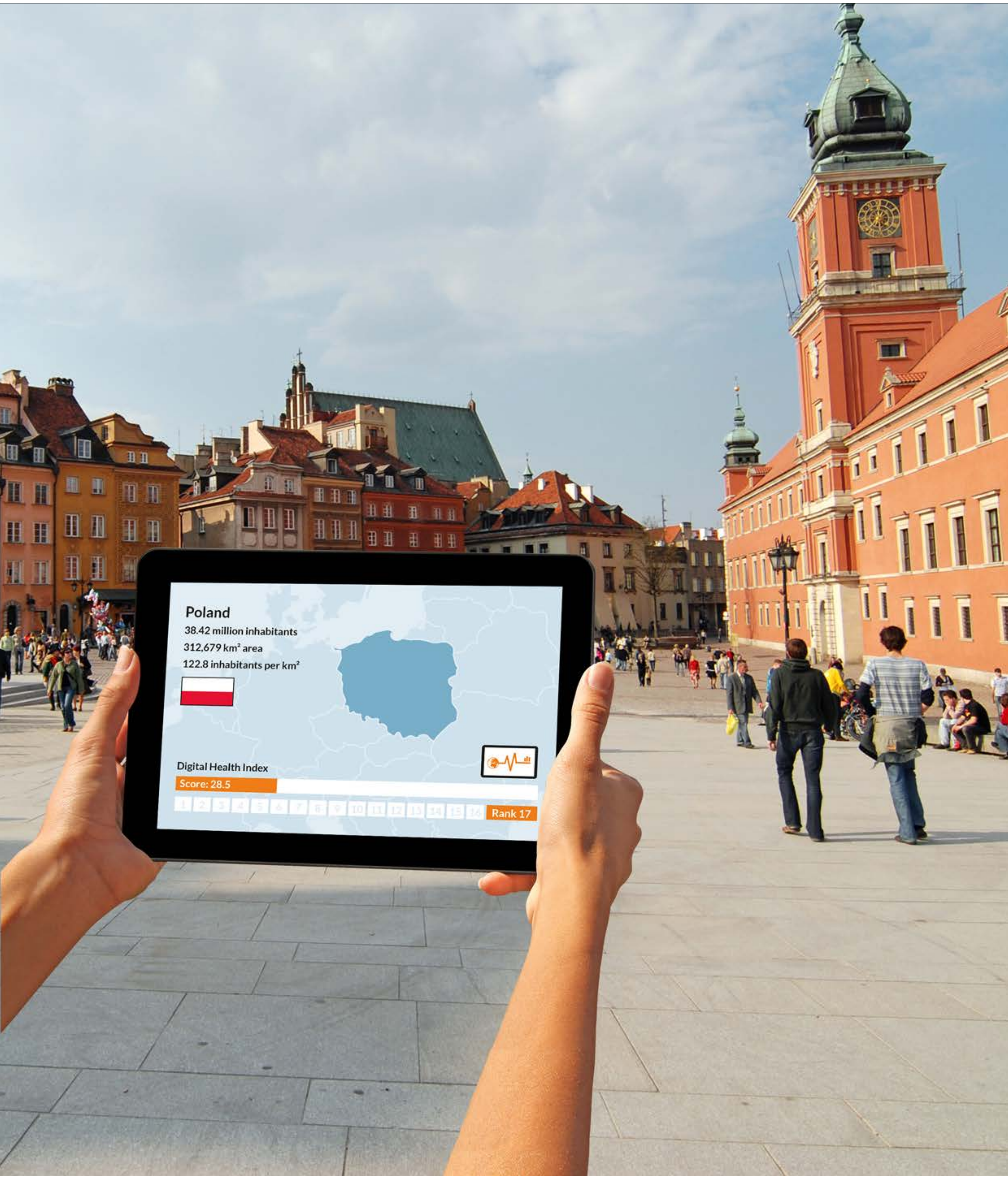
3.13.6 Digital Health Index: comparison with Germany

In a comparison of the results of the relative percentages achieved in the Digital Health Index and the three sub-indices of Austria and Germany, it is noteworthy that Austria scores higher in all areas than Germany, but produces a similar ratio overall between the indices. In both countries, policy activity is ahead of digital health readiness and just above the lowest-ranked actual data usage.

FIGURE 31: **Comparison between Germany and Austria,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity Digital Health Readiness Actual use
Source: Bertelsmann Stiftung


Poland
38.42 million inhabitants
312,679 km² area
122.8 inhabitants per km²
Digital Health Index
Score: 28.5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Rank 17

3.14 Poland

3.14.1 The national healthcare system

Service provision

The constitution that came into effect in October 1997 guarantees all Polish citizens equal access to all health services financed from public sources. Since 2003 this has been administered by the National Heath Fund (NFZ), which is responsible for securing medical care through contracts with public and non-public service providers. It is made up of centralized and regional agencies in the 16 administrative districts, and reports to the Health Ministry. The ministry decides on the NFZ's financial resources and the scope of its services. In addition, there are private insurers which offer services commensurate with the amount paid by the policy-holder.

Financing

Poland offers subsidized public insurance which compulsorily covers all citizens who are in gainful employment. Children and young adults 25 and under, and spouses who are not in the labor market, are co-insured without premiums; the unemployed are also exempt. Seventy percent of Poland's health expenditure is borne by the public sector. The Polish state spends comparatively little on its health system (6.3 percent, 2015). This can be traced back to the stringent saving measures introduced by the government in the wake of the financial crisis. This comparatively modest health spending results in higher excesses for services that are in fact guaranteed. Here the principle of benefits-in-kind applies as long as patients are treated by service providers who are contractually affiliated with the NFZ. Around 40 percent of expenses are borne by Polish patients themselves (pharmaceuticals and devices, certain diagnostic methods and health resorts, as well as dental services).

Care provision

The Polish health system is based on a primary care physician system. Primary care physicians and GPS manage health care and function as gatekeepers to specialists and inpatient care in hospitals. Patients may switch primary physicians twice in a year without charge. Inpatient care is carried out by hospitals and polyclinics that are contractually bound to the NFZ. Through referrals, patients may choose freely between facilities. Around 90 percent of hospitals are in public hands, but conditions in some are significantly poorer than in new facilities which emerged after the collapse of Communism.[240]

3.14.2 Development of digital health

The Polish Health Ministry is responsible for all matters pertaining to health – including the development, supervision, rollout and funding of strategies and projects related to digital health. The Ministry of Digital Affairs plays an important if secondary part as it drives digital services for society, including digital health services. Responsibility for technical infrastructure and project evaluation falls to the National Center for Health Information

240 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

Systems (Centrum Systemów Informacyjnych Ochrony Zdrowia (CSIOZ)), which collects and processes data around the issue of digital health, and also reports to the Health Ministry. The Polish provinces tend to conduct their own projects, which often take place in the context of national initiatives and state-funded projects.

Digital health is regulated by a number of laws;[241, 242] it is regarded as a key component of future-oriented health care and the Digitalization Ministry has been tasked with driving digital health projects – yet the IT infrastructure remains relatively underdeveloped in comparison with the other 16 countries surveyed.

Polish efforts to introduce digital health are primarily aligned with EU action plans and priorities that are reflected in national legislation. That includes a range of projects (P1-4) for online platforms, telemedicine, electronic health records and management systems that are largely made possible through external financing. These platforms are designed to offer medical service providers an insight into their patients' insurance status and a history of previous doctor visits, and to allow them to export statements via the national insurance scheme. However, most of these projects have been hampered by major setbacks and delays; the causes include insufficient state financing (most funds come from EU sources that have since ceased operation), poor IT infrastructure in hospitals and deficient communications between the Health Ministry, the NFZ and the CSIOZ. Indeed, a third of hospitals in Poland do not use any form of electronic documentation system for patient data.

FIGURE 32: **Map of digital health in Poland**

Digital Health Index
Score: 28.5

Enablers: strategies, standards, institutions				
Legal framework conditions			Institutional anchoring	
Data protection regulations	Data security	Technical standards	National digital health agency	Financial ressources and incentives
Legal certainty	Medical terminology guidelines	Semantic standards	Enforcement of standards	Stakeholder engagement

Digital health infrastructure				
Universal national patient identifier	Transparent national access regulations	Provider and service registers	Technical data infrastucture	Automatic retrieval of patient data

Digital health applications					
Electronic Health Record (EHR)		Health services		Health information	Healthcare provision
Vaccinations	Medication list	EPrescription	Video consultations	Patient portal	Health system monitoring via EHR
Laboratory results	Patient access control	Online appointments		Health information portal	Health services research
Patient Summary	Structured and coded content	Telehealth			

■ available (two thirds of the questions answered positively)

Source: Bertelsmann Stiftung

241 *Information Systems in the Health Sector Act 2011.*
242 *Patients' Rights Act 2008.*

Figure 32 summarizes existing digital health components identified in the course of this study (green-shaded fields).

3.14.3 Policy activity and strategy

Digital health strategies

In late 2017, a successor plan to the old digital health strategy was presented for the period 2018-2022. Political actors, as well as representatives from providers, insurers and patient associations all contributed to its formulation.[243] The digitalization process is being driven at various political levels and by health service providers. The Health Ministry Ordinance of 9 November 2015 on the forms, scope and models of medical documentation and methods for processing had already addressed potential security and confidentiality risks associated with large-scale retention/referencing and data exchange of personal health data.[244]

With the end of EU subsidies in 2015, the present government has announced that it will be revising plans for the development of digital healthcare services and breaking it down into smaller projects.[245] However, this announcement failed to offer details for a number of elements, including the creation of an internet portal with access to health information, an ePrescription service and electronic health records. In the past, delays and a lack of legislation led to the postponement of implementation plans for various projects.[246] While the participation of various stakeholders has brought noticeable improvement to the formulation of the current digital health strategy, greater collaboration is required from these actors, particularly in the development and implementation of applications.

Institutional anchoring, financing and legal framework

To date, the lack of consistent standardization plans has represented a particular hindrance to the interoperability of new digital applications.[247] One planned response is to begin the rollout of a uniform documentation structure (HL7 CDA). The National Center for Health Information Systems is responsible for all standardization tasks and for monitoring development and rollout of digital health applications. In the past, it also supported the government in its adaptation of existing legislation to encompass digital health.

The Health Ministry occupies a key role in the area of digital health. Its influence is felt not only through legislation, but on behalf of the state it also drives the development of new digital applications which upon completion are made available to all service providers in the healthcare sector. Reforms targeting reimbursement for regular (analog) health ser-

243 Gov.pl. (2018). *Prezentacja "Strategii Rozwoju e-Zdrowia w Polsce na lata 2018–2022."* [online] Ministerstwo Cyfryzacji. Available at: https://www.gov.pl/cyfryzacja/prezentacja-strategii-rozwoju-e-zdrowia-w-polsce-na-lata-2018-2022.

244 *Health Ministry Ordinance of 9 November 2015 on the forms, scope and models of medical documentation and methods for processing.*

245 Polityka Insight (2017): *Transforming eHealth into a political and economic advantag.* [pdf] Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwjvk7L-t9DcAhUHyKQKHXbrAPYQFjAAegQIABAC&url=http percent3A percent2F percent2Fmichalboni.pl percent2Fmboni percent2Fwp-content percent2Fuploads percent2F2016 percent2F11 percent2FeHealth-report-06.03.pdf&usg=AOvVaw2jplLrshymyE3YKVhl6TjV.

246 Sources: national correspondent and survey results.

247 Kautsch, M., Licho,M., and Matuszak, N. (2016). Development of Publicly Funded eHealth in Poland: Barriers and Opportunities. In: *Economics & Sociology*, Vol. 9, No 3.

vices and medication have been implemented since 2016.[248] However, there is still no clear indication of the extent to which health insurers will incorporate the first electronic services into their service portfolios.

The NFZ issues highly detailed requirements to healthcare services, entering into arrangements with care providers that permit no divergence whatsoever. These agreements are resource- and process-oriented rather than results-oriented. Should a healthcare facility wish to improve the quality and effectiveness of its services in a way that diverges from the provisions of its agreement with the NFZ (which issues standard agreements for all services), it will receive no compensation for the provision of these additional services. Overall this is the largest barrier to any form of innovation in healthcare (including digital health) in Poland.[249] The reason is the Health Care Professions Act of 1998, which stipulates that a physician must examine a patient in person. This represents an implicit ban on examination via telemedicine. There are two exceptions to this: the electronic appointment system that has been implemented in some regions, and electronic communication of x-ray results, which are not specifically regulated by the NFZ. These limitations do not affect any of the services outside the public-health sector (private patients). The government provides financial support for regional digital health programs, which also serve as funding for infrastructure expansion. Moreover, the regions continue to benefit from EU subsidies.[250]

Poland's legislative restructuring and adjustment process is ongoing. Along with the 2015 ordinance, a further adjustment came as the right of access to personal health data via electronic communication methods was enshrined in legislation. With the introduction of the GDPR, all legislation related to data protection is undergoing revision and adjustment.[251] Responsibility for overseeing adherence to data protection regulations, including the healthcare sector, falls to the Inspector General for Personal Data Protection. Health data may be used for both statistical and research-related purposes.

A 2016 study found that just 7 percent of all Polish hospitals spend more than 3 percent of their annual budgets on IT systems and infrastructure. In fact, more than two-thirds of all hospitals spend just 1 percent on IT equipment. As a comparison, 19 percent of German hospitals spend less than 1 percent of their budgets on IT, 60 percent between 1 and 3 percent, almost 12 percent as much as 3 to 5 percent, with 9 percent of all hospitals devoting more than 5 percent of their budgets to technical infrastructure.[252]

248 hspm.org, (2018). *Poland: Health Systems in Transition (HiT) profile of Poland.* [online] The Health Systems and Policy Monitor. Available at: http://www.hspm.org/countries/poland27012013/livinghit.aspx?Section=2.8 percent20Regulation&Type=Section.

249 See also: Kautsch, M., Licho,M., and Matuszak, N. (2016). Development of Publicly Funded eHealth in Poland: Barriers and Opportunities. *Economics & Sociology,* 9(3).

250 ec.europa.eu, (2018). *ROP 6 Regional Operational Programme for Małopolskie Voivodeship 2014-2020.* [online] European Commission. Available at: http://ec.europa.eu/regional_policy/en/atlas/programmes/2014-2020/poland/2014pl16m2op006.

251 thelawreviews.co.uk, (2017). *Poland.* [online] The Law Reviews. Available at: https://thelawreviews.co.uk/chapter/1151294/poland.

252 Kwiatkowska, E. (2016): IT Solutions for Healthcare System in Poland: In Search of Benchmarks in Various Economic Perspectives. *Economics & Sociology,* 9(3).

3.14.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

A uniform, unique means of identification, or patient identity card, is currently in planning, with development not expected to begin until 2019. Medical specialists, on the other hand, are registered centrally.

With respect to data protection and privacy, so far it is only access rights and processing rights that are regulated nationally. Technical security provisions (e.g., de-identification and encryption of data) have not yet been adjusted.

Digital health applications and services

National digital applications are still currently in the planning phase. The sole service to be completed since the start of EU funding of digital health projects is the platform for medical records.[253] This platform contains an electronic archive that enables the storage and long-term archiving of documents in electronic form. This captures such information as the patient's last visit to a doctor, operations and recently purchased medication, along with information regarding costs,[254] although it is the administrative side of the healthcare sector that tends to benefit most from this.

While there is no legislative impediment to telemedicine services such as online consultation with patients, the NFZ is still yet to recognize it as a billable service at the national level. This represents an almost impenetrable barrier to nationwide expansion.[255]

Three further digital health projects are currently in planning. They include a health information portal for access to personal health data and an "Internet patient account," and an electronic health record (EHR) which is expected to absorb all health documents. But the rollout of these projects has been particularly hindered by interoperability problems and a lack of technical infrastructure and equipment in hospitals and medical practices.

Data integration and exchange readiness

The National Center for Health Information Systems is working successfully on defining standards for future services – ePrescription, eReferral and other documents that are expected to be included in the projected EHR. This encompasses exchange standards as well as clinical documentation and terminology standards for all areas of healthcare. The center is also making informational and training material available to medical personnel. Yet these standards are still not being applied, as none of the applications has yet been implemented. And the penetration of uniform documentation standards currently stands at less than 25 percent.

Poland offers no statutory framework for transnational data exchange, nor are there projects or initiatives under way in this area.

253 National Centre for Healthcare, (2016): *Healthcare Informatisation.*
254 csioz.gov.pl, (2018). *Rejestry medyczne.* [online] Centrum Systemow Informacyjnych: Ochrony Zdrowia. Available at: https://www.csioz.gov.pl/projekty/zrealizowane/rejestry-medyczne/.
255 Sources: national correspondent and survey results.

TABLE 21: **Digitalization profile Poland**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
	■				P1	Digital health is an integral part of general health policy
		■			P2	Political will to support data transfer and data exchange is advanced
			■		P3	An effective strategy to digitalise the healthcare system is in place
			■		P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
				■	P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
			■		P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
		■			P7	A national digital health entity has been established for oversight of digital health implementation
		■			P8	Digital health service refunding and financing is in place on the national / regional level
			■		P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
			■		P10	Legal frameworks in place to protect sharing of patient data
	■				P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
		■			T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
			■		T2	Sufficient security actions are in place to secure patient privacy
			■		T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
				■	T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
				■	T5	EPrescription services are operational
			■		T6	Telehealth and telemedicine can be routinely used
				■	T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
				■	T8	Patient control of content and access to the EHR
				■	T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
	■				T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
				■	T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
				■	T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
				■	T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
				■	A1	Digital health applications are a dominant solution for direct patient care
				■	A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
				■	A3	Level of EHR uptake is high
				■	A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
				■	A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
			■		A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
				■	A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung

3.14.5 Actual use of data

Electronic documentation of clinical data in medical practices and hospitals is far from fully established in the Polish health system. Only 25 percent to 50 percent of all doctors in Poland document data using computerized systems – a clear indication of deficiencies in networked infrastructure and financial support.

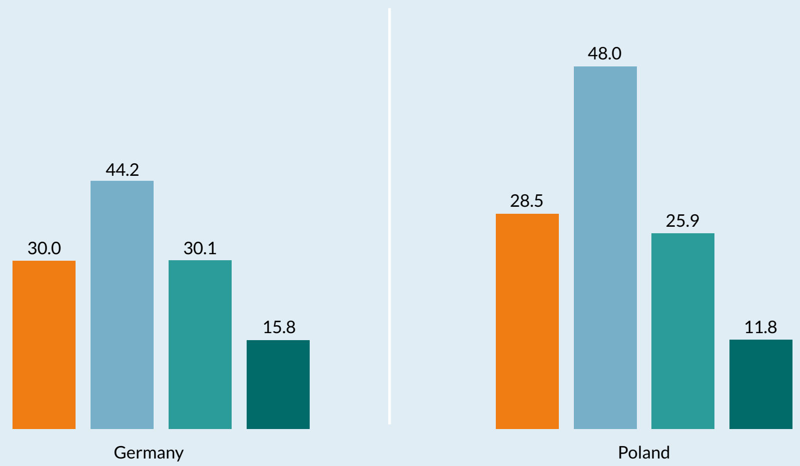
At the national level, digital data exchange is more or less nonexistent. In 2016, 6 percent of the Polish population booked doctor's appointments online and 4 percent were able to view their hospital data in online medical records. Among Poland's hospitals, 29 percent exchange clinical data electronically with other providers, although usually through hospital files rather than completely interoperable systems.[256, 257]

To date, the NFZ has only gathered and evaluated epidemiological and health-related data. Some of its datasets are still drawn from paper records.[258]

3.14.6 Digital Health Index: Comparison with Germany

When comparing the three sub-indices and the Digital Health Index for Poland and Germany, it is clear that both countries perform best in the area of policy activities. Overall, the two countries present a very similar picture, with both faring last in the index for actual data usage. The two countries find themselves at similar points on the scale, each coming in at less than 50 percent below the optimal level.

FIGURE 33: **Comparison between Germany and Poland,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity, Digital Health Readiness, Actual use
Source: Bertelsmann Stiftung

256 Kwiatkowska, E. (2016): IT Solutions for Healthcare System in Poland: In Search of Benchmarks in Various Economic Perspectives. *Economics & Sociology*, 9(3).
257 It should be noted that this study examined the extent of digitalization and the exchange of data in relation to electronic health records. There is a clear distinction between medical records and EHRs, a fact that accounts for the low scores. See the Glossary for more information on definitions.
258 Sources: national correspondent and survey results.


Portugal
10.30 million inhabitants
92,212 km² area
111.7 inhabitants per km²
Digital Health Index
Score: 67.2
Rank 8

3.15 Portugal

3.15.1 The national healthcare system

Service provision

Portugal has a centralized, state-managed national healthcare service which provides services to all citizens. Five regional health authorities were established in the 1990s, although they are only responsible for financing the area of outpatient care, with state authorities retaining responsibility for hospitals and their financing. The population has a choice of various healthcare systems, although some are reserved for certain professional categories (e.g., public servants, military personnel, police officers, bankers). Around a fifth of the Portuguese population also take out private insurance, for which premiums may be claimed on tax.

Financing

The public healthcare service bears almost 60 percent of all costs itself, with 90 percent of this amount coming from fiscal means and the rest from supplementary payments and personal contributions from patients who use additional services. Measured against GDP, the state spent 8.9 percent of its budget on the healthcare system in 2015, placing it in the bottom half of the most expensive systems in Europe. Although they represent relatively small amounts, supplementary patient payments play an important part in Portugal.

Care provision

With outpatient care offered in hospitals, the healthcare service does not cover consultation with private specialists. General practitioners, who are in an employment relationship with the healthcare service, theoretically function as gatekeepers. While some work in practices, many others operate out of local health centers. In practice, however, many Portuguese get around this fact by going directly to private specialists or getting admitted through the emergency room. Around 35 percent of hospitals are in public hands, and 65 percent private. Portugal has relatively few hospital beds compared to international standards, with 3.4 per 1,000 residents in 2011; the OECD average for this indicator is 4.7.[259]

3.15.2 Development of digital health

One of the goals of Portugal's 18th government was that every citizen would have an electronic health record (EHR) by 2012, and that it would be accessible in electronic form. In December 2009 the Health Ministry established the Digital Health Agency (Serviços Partilhados do Ministério da Saúde, or SPMS), a public body tasked with the provision of "shared" or networked electronic services in all facilities of the national healthcare service. Its role in Portugal is to drive the distribution and development of digital healthcare services.[260] The National Commission for Clinical Information Technology (Comissão para a Informatização Clinica) was established in 2011 to develop and roll out a national health informa-

259 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.
260 Spms.min-saude.pt, (2018). *SPMS – Serviços Partilhados do Ministério da Saúde.* [online] Available at: http://spms.min-saude.pt/a-spms/.

tion platform and a summary document containing clinical data, or clinical patient summary (Resumo Clinico Único do Utente, or RCU2). These goals were reached in 2012 and the National Commission for Clinical Information Technology was replaced by the National Commission for Monitoring Clinical Information Technology (Comissão de Acompanhamento da Informatização Clinica), which reports to the SPMS. The National Data Protection Commission (Comissão Nacional de Proteção de Dados) has a decisive role in processing and access to data. It is the independent supervisory authority, monitoring all implementations regarding human rights, data protection and all other freedoms guaranteed under Portuguese law. In the event of infringement it may decide to impose either a temporary or complete block and to destroy certain data, and halt the entire data processing process. In 2012 it authorized the establishment of the RCU2 and the National Platform for Health Data.[261]

The think tank "eHealth in Portugal: Vision 2020" was an initiative of the SPMS, which established a forum for reflection and debate about the Portuguese digital health strategy for the period 2016-2020. The group's work resulted in the paper "eHealth in Portugal – Vision 2020," which called for intensive efforts in the area of mHealth, increased standardization (there are currently dozens of different EHRs in Portugal) and the strengthening of existing projects as pillars of Portuguese digital health and international cooperation (following earlier successes, such as epSOS). It has also set the course for a national strategy in the area of digital health.

FIGURE 34: **Map of digital health in Portugal**

Digital Health Index
Score: 67.2

Enablers: strategies, standards, institutions

Legal framework conditions: Data protection regulations; Data security; Technical standards; Legal certainty; Medical terminology guidelines; Semantic standards

Institutional anchoring: National digital health agency; Financial ressources and incentives; Enforcement of standards; Stakeholder engagement

Digital health infrastructure

Universal national patient identifier; Transparent national access regulations; Provider and service registers; Technical data infrastucture; Automatic retrieval of patient data

Digital health applications

Electronic Health Record (EHR): Vaccinations; Medication list; Laboratory results; Patient access control; Patient Summary; Structured and coded content

Health services: EPrescription; Video consultations; Online appointments; Telehealth

Health information: Patient portal; Health information portal

Healthcare provision: Health system monitoring via EHR; Health services research

available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

261 Moreira, G. (2014). *Overview of the national laws on electronic health records in the EU Member States: National Report for Portugal.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_portugal_en.pdf.

Figure 34 summarizes existing digital health components in Portugal identified in the course of this study (green-shaded fields).

3.15.3 Policy activity and strategy

Digital health strategies

Portugal's national digital health strategy, the 2016 National Strategy for the Health Information Ecosystem 2020 (ENESIS 2020), aims primarily at improving the cost effectiveness of the entire healthcare system through digital solutions. A further goal is a combined strategy for meeting overall health policy objectives with the help of centralized digital solutions. As Portugal is administered centrally, authority in the healthcare sector is not delegated to the regions.

Politically, digital health initiatives are strongly supported by the health minister.[262] The SPMS, which is affiliated with the Health Ministry, effectively implements European projects at the national level. The SPMS bears responsibility for telemedicine services and solutions, mHealth and the National Platform for Health Data, and pursues objectives of its own devising in their implementation. The rollout of a national network for the exchange of health information (in this case the electronic patient summary RCU2) also benefits from the strategic and conceptual assistance of the SPMS and the ministry. The ICT Vision 2020: Strategy for electronic transformation in public administration by 2020 for technical and semantic interoperability addresses the focal points of integration and interoperability, innovation and competitiveness, as well as resource- and data-sharing.[263]

Although to date there has been no nationwide, unified, legislation with precisely calibrated impact with a view to the opportunities and risks of big data in the healthcare sector, the rollout of a national network for exchange of health information is supported strategically and conceptually by the ministry and the SPMS. It bears responsibility for telemedicine services and applications, mHealth and the Portuguese Platform for Health Data.

As part of the ENESIS 2020 strategy, the SMPS works with the government to set annual milestones that can be enshrined in a strategic action plan and evaluated internally. However, the milestones are not legally binding and there are no negative consequences for non-fulfillment. The interest groups who participate in the planning and implementation of digital health applications usually consist of representatives of healthcare service providers, suppliers, insurers and patient organizations, with less representation from business.[264]

262 European Health Parliament, (2018). *What's the future for health care in Europe?.* [online] healthcare.digital. Available at: https://www.healthcare.digital/single-post/2018/03/28/What percentE2 percent80 percent99s-the-future-for-health-care-in-Europe?utm=candesic_website.

263 Serviços Partilhados do Ministério da Saúde (SPMS), (2017). *Estratégia TIC 2020: Estratégia para a transformação Digital na Administração Pública,* [pdf] Available at: https://tic.gov.pt/documents/CTIC__TIC2020__Estrategia__TIC.pdf.

264 Sources: national correspondent and survey results.

Institutional anchoring, financing and legal framework

Within the SPMS there are initial indications of collaboration with actors from the business sector, and of the total budget for the agency, which in 2017 amounted to almost € 600 million, € 200 million was earmarked for international digital health projects and national initiatives.[265] The SPMS has far-reaching competencies with relation to enforcing terminological and technical standards that it defines as mandatory.

As a foundation, the Portuguese Digital Health Agency assumes responsibility for most functions in the area of digital health under the oversight of the Health Ministry. It retains responsibility for the formulation of strategies and their implementation. It works with the health minister and data protection authorities to address such issues as revision of data protection legislation.[266] While certain activities and services are evaluated internally, no regular monitoring concept has been established to measure the influence of digital services on the whole healthcare system.

For the national health service to be able to offer digital services, it makes a dedicated budget available to the SPMS that covers operations, development and treatment. The government also provides financial support to national programs. Practicing physicians can now settle payment for telemedicine services with the national health service just as they do in-person doctor's appointments and examinations.

To reach the annual implementation objectives of the SPMS, public funds can be used to subsidize expansion of technical infrastructure directly in treatment venues, in practices and hospitals.

Storage and transfer of health-related data is not regulated by a specific law in Portugal, but rather directly through ENESIS 2020. This also regulates handling of electronic health records. In 2012 the data protection authorities approved the establishment of a comprehensive health data platform that guarantees access to a range of datasets for organizations, service providers and also patients.

In general, patient data may only be used for research purposes or if there is a particular public interest in the use of the data. This, too, is aligned with overall aims for improvements to the provision of healthcare. In the area of data processing and access, the National Data Protection Commission (Comissão Nacional de Proteção de Dados) has a decisive role – it is the independent supervisory authority and evaluates all digital applications with regard to maintenance of personality rights, data protection and other freedoms under Portuguese law. In the event of infringement it may decide to impose either a temporary or complete block and to destroy certain data, or halt the entire data processing process. In 2012, it authorized the establishment of the RCU2 and the Platform for Health Data.[267] There are no specifically mandated procedures for the formatting, access, archiving or transfer of data.

265 Serviços Partilhados do Ministério da Saúde (SPMS), (2017). *Plano de Atividades Investimento e Orcamento de 2017.* Lisbon: p.20.

266 Moreira, G. (2014). *Overview of the national laws on electronic health records in the EU Member States: National Report for Portugal.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_portugal_en.pdf.

267 Vieira de Almeida & Associados, (2014): *Data Protection in Portugal: overview. Q&A.* Lisbon.

Only a few universities have incorporated the use of digital health applications into their curricula. Some hospitals and larger healthcare facilities, on the other hand, offer further vocational training. And in their last year of training, healthcare professionals learn how to use facility-specific digital services. However, there is no structured, uniform national concept here, rather real-life practice which differs from facility to facility.[268]

3.15.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Each practicing physician in Portugal has an identification number for authentication when accessing patient data. Generally, though, physicians can only access the files of patients who are registered with their facility. To date citizens have only been identified with a health insurance card when they visit their physician, and there have been technical problems with the unique identification of patients. A new electronic identity card is currently being rolled out at the national level.

For normal routine in hospitals and doctors' practices there is no encryption or de-identification methods used to protect patient data. Patients have limited control over their own health data, as the physician can decide what parts of the EHR to make visible.

Within the Digital Health Agency there is a department tasked with establishing semantic interoperability through uniform terminology standards and classification systems. Progress in this area is both supported and monitored in the long term by representatives from all healthcare sectors of the Portuguese healthcare system.

The patient summary RCU2 is part of a larger, comprehensive electronic health record which offers an overview of a patient's medical history. The RCU2 will contain summary information of the last treatment by each general practitioner or specialist where this may be relevant for other physicians. A national platform is used to access and display all patient data in local storage sites of the hospitals and medical practices.

Digital health applications and services

The national rollout of an ePrescription service was determined by ordinance in 2015 and introduced as a statutory obligation in 2016.[269] This means that prescriptions, as well as confirmation of delivery, can now be sent electronically to the physician or pharmacist. The electronic health record is also linked to this system.

Telemedicine services have not yet been implemented nationwide as a part of routine healthcare. For certain chronic patient groups and peer-to-peer communications there are initial pilot projects which are being rolled out nationally. Remote monitoring and online consultation have only been possible in limited, local scope to date.

268 Sources: national correspondent and survey results.

269 Moreira, G. (2014). *Overview of the national laws on electronic health records in the EU Member States: National Report for Portugal.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_portugal_en.pdf.

The national health platform PDS is not just a central access point through which physicians and patients can view health data,[270] it also promotes public awareness, communicating general health information to the population. Patients can only amend data and information in their electronic files that they themselves have entered. This information can also be enabled or blocked for physicians generally. The information in the patient summary RCU2 cannot be changed.

While there is no official provision for monitoring via mobile health apps, the SPMS has unofficially adopted this practice. Mobile devices will soon have online access to the PDS platform. To date, there have been no official plans or development programs in the area of mHealth.

National Platform for Health Data (PDS)

The National Platform for Health Data is a web platform developed by SPMS and operated by all national health institutions which offers a central system for the capture and exchange of clinical information in accordance with the requirements of the National Data Protection Commission. The platform offers both citizens and healthcare professionals access to information.

1. the portal for healthcare professionals (Portal do Profissional),
2. the international portal (Portal Internacional),
3. the Portal Institucional, which provides anonymous data and statistics,
4. the patient portal (Area do cidadão of the national health portal) and
5. the administrative portal.

The portal for physicians provides three different types of information:

1. the electronic medical record of the facility where the patient receives treatment.[271] This information cannot be changed, and summarizes all treatment in that facility.
2. Instructions of the attending physician on the patient's administrative information
3. a list of all other electronic medical records from other healthcare facilities that treating physicians believe may be relevant to specialists and other healthcare professionals. In turn, a specialist may inform a patient's general practitioner of new, essential findings for that patient, or request that he or she make available certain information for consultation. This portal summarizes the entirety of the patient's medically relevant data into a patient summary (RCU2) and can be a valuable aid – if a patient is admitted to an emergency room, for instance. According to Par. 7(4) of the Data Protection Act, the patient summary may be created with out the patient's consent, as it is used for the processing of data aimed at medical prevention. Should a physician add to or change data in the medical record, this is transferred to the PDS.

The patient portal serves as an electronic patient mailbox and can be administered by patients themselves. Here they can enter data that they have gathered themselves (e.g., blood pressure, cholesterol levels, blood sugar, weight, etc.) and make it accessible to consulting physicians or nurses. Patients have full control over this data and can see who has accessed it. Using an electronic identity card, every patient can register for the portal, book doctor's appointments and view waiting lists for operations.

270 Min-saude.pt, (2013). *PDS – Plataforma de Dados da Saúde: O que é a Plataforma de Dados da Saúde?*. [online] Available at: http://spms.min-saude.pt/2013/11/pds-plataforma-de-dados-da-saude/.
271 *The electronic file, whose content and data is limited to the holding facility (e.g., a hospital file).*

At the European level, physicians can access the RCU2 through a third, international portal which requires the patient's consent. A fourth portal will be established in the future to make anonymous health data available for statistical and epidemiological processing and research.[272] In 2012, the Platform for Health Data was expanded after years of opposition from the National Data Protection Commission.

Data integration and exchange readiness

The national Digital Health Agency SPMS regulates and defines all standards related to technical and semantic interoperability in the public sector and also cooperates with private suppliers of electronic health records. All health data traffic takes place through the PDS platform, so there is less emphasis on actual interoperability than on uniform application of clinical classification systems and terminologies. There are certainly different standards used in the inpatient and outpatient-care sectors, and only 50 percent-75 percent of medical facilities use them as internal guidelines in documentation for physicians and other personnel.[273] A uniform system is used nationwide to document services and for settlement with the national insurer.

Less than 25 percent of EHR systems and other health registries in Portugal are able to communicate with each other or transfer data to the national authority tasked with monitoring the quality and efficiency of the health system.[274] There are even cases in which the same patient is registered in different systems with different identifiers and can therefore not be uniquely identified. Most physicians in outpatient care cannot retrieve information on their patients in the inpatient care sector through their own information systems, and in these cases must use the PDS.[275]

Portugal has taken part in international data exchange projects in the past and has created national framework conditions to enable exchange of patient data with other EU countries, particularly the patient summary, under the umbrella of epSOS.[276]

272 See footnote 268. The information was gathered in collaboration with the Portuguese Digital Health Agency and confirmed by third parties.
273 Sources: national correspondent and survey results.
274 Sources: national correspondent and survey results.
275 De Almeida Simoes, J., Figueiredo Augusto, G., Fronteira, I., and Hernandez-Quevedo, C. (2017). Portugal Health system review. *Health Systems in Transition.* [online] 2017 Nr. 19 (2), p. 150f. Available at: http://www.euro.who.int/___data/assets/pdf_file/0007/337471/HiT-Portugal.pdf.
276 ec.europa.eu, (2017). *Digital Single Market: epSOS achievements – now also in Portugal.* [online] European Commission. Available at: https://ec.europa.eu/digital-single-market/en/news/epsos-achievements-now-also-portugal.

3.15.5 Actual use of data

The degree of distribution of electronic systems for documentation of health data in Portugal is greater than 75 percent. Each healthcare facility is linked to the national health information network and more than 75 percent of the population is captured in this system. According to the 2016 law, prescriptions in the outpatient-care sector can only be issued and sent digitally.[277] Both outpatient and inpatient care as well as the highly specialized sector of the Portuguese healthcare system use the Platform for Health Data (PDS) as a data exchange platform. The following information systems are also linked to the PDS and enable data exchange:

- laboratory information systems
- pathology information systems
- pharmacy information systems
- image archive and communications systems
- automatic vaccination reminder systems

In Portugal there is more data exchange between resident general practitioners (>75 percent) than between general practitioners and specialists or hospitals (50 percent-75 percent).[278] In general, clinical data may only be used for research in very specific cases, for which a special request must be made to the Data Protection Commission. In general, anonymized patient data from more than 10 national datasets is used to generate performance reports of the healthcare system and identify areas in need of improvement. Automatic reading of EHR systems and data transfer to national datasets is primarily used for settlement of payment with the national insurer and is supported by formalized standards. This applies to the following datasets (approx. 25 percent-50 percent of all nationally available health registries):

- inpatient psychiatric data
- emergency treatment data
- information from outpatient care
- medication and prescription information
- diabetes registry data
- cardiovascular registry data

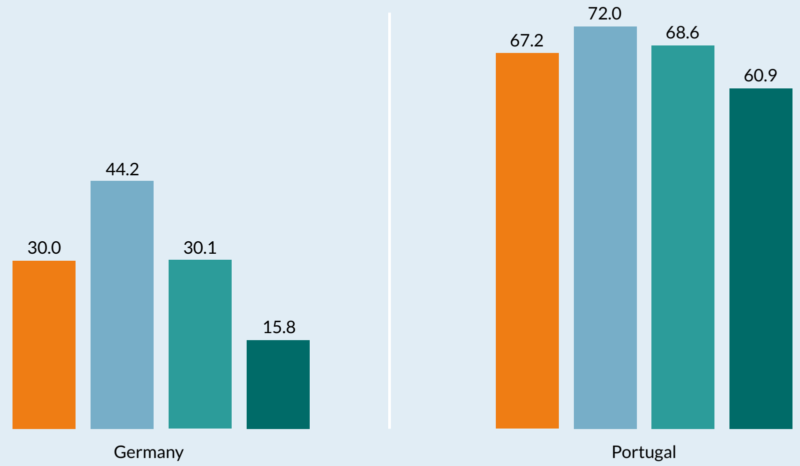
Despite efforts to introduce a uniform terminology standard in the documentation of clinical data, it is estimated that fewer than 25 percent of all entries are structured and uniformly coded. This may be driven by inconsistent standards in inpatient and outpatient care and a lack of obligation to apply them consistently.[279] Only about 25 percent of the Portuguese population is theoretically in a position to view their own health information via the PDS and fewer than 25 percent of Portuguese used the health information portal for informational purposes in 2017.[280]

277 Sources: national correspondent and survey results.
278 Sources: national correspondent and survey results.
279 With the exception of settlement of payment with the national insurer.
280 Sources: national correspondent and survey results.

3.15.6 Digital Health Index: Comparison with Germany

In a comparative view of the Digital Health Index between Portugal and Germany it is immediately apparent that not only do the southern Europeans score higher in each area, but that they present a more balanced picture overall. While both countries score highest for policy activity, with actual data use the lowest of the three sub-indices, the intervals between sub-indices are much smaller for Portugal.

FIGURE 35: **Comparison between Germany and Portugal,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity, Digital Health Readiness, Actual use
Source: Bertelsmann Stiftung

TABLE 22: **Digitalization profile Portugal**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
	■				P1	Digital health is an integral part of general health policy
	■				P2	Political will to support data transfer and data exchange is advanced
	■				P3	An effective strategy to digitalise the healthcare system is in place
		■			P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
		■			P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
■					P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
	■				P7	A national digital health entity has been established for oversight of digital health implementation
	■				P8	Digital health service refunding and financing is in place on the national / regional level
	■				P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
		■			P10	Legal frameworks in place to protect sharing of patient data
		■			P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
	■				T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
		■			T2	Sufficient security actions are in place to secure patient privacy
	■				T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
	■				T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
■					T5	EPrescription services are operational
		■			T6	Telehealth and telemedicine can be routinely used
	■				T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
			■		T8	Patient control of content and access to the EHR
			■		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
	■				T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
			■		T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
			■		T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
■					T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
	■				A1	Digital health applications are a dominant solution for direct patient care
■					A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
		■			A3	Level of EHR uptake is high
	■				A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
			■		A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
	■				A6	For monitoring and improvement of healthcare systems health data is used regularly
			■		A7	Automatic extraction of health data from EHR systems to national databases is pervasive
			■		A8	The quality of data and clinical content of electronic records being shared among providers is high
				■	A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply
Source: Bertelsmann Stiftung


Sweden
10.12 million inhabitants
447,435 km² area
22.6 inhabitants per km²
Digital Health Index
Score: 68.3
Rank 7

3.16 Sweden

3.16.1 The national healthcare system

Service provision

The healthcare system in Sweden offers a public healthcare service for the benefit of the entire population, which is organized and financed at the local authority level. While the state is gaining more influence in the form of statistical surveys and data collection competencies, its most important role remains the formation of health policy framework conditions. The 21 districts and local authorities are responsible for ensuring outpatient and inpatient care. The social security system remains configured as a public insurance scheme. Private health insurance is becoming increasingly important, particularly in the face of longer waiting lists for outpatient treatment and operations. However, only 5 percent of Swedes are privately insured.

Financing

In 2015, the proportion of health expenditure relative to GDP was 11.1 percent, putting Sweden significantly ahead of the OECD average. Public expenditure for the healthcare system is also above average, at 82 percent. The majority of funding comes from district taxes and social-insurance contributions; a small part comes through allocations from the state, which is intended to compensate for the financial capacity of the local authorities, and also to support health policy functions. The districts spend around 90 percent, and municipalities around a third of all expenditure on financing healthcare services.

Care provision

Most physicians in the Swedish districts are in employment relationships and operate in public health centers. Outpatient physicians enter into contracts to render certain services. Only in some districts do physicians have a gatekeeper function. Specialist outpatient care is largely carried out in hospitals. Patients can essentially choose freely between the service providers in their district. If this treatment cannot be guaranteed within 90 days, the district must organize for treatment to take place in another district, but there the patient has no right to treatment and – in the worst-case scenario – will be placed on another waiting list. Most of the hospitals are in public ownership by the districts and only a small proportion are privately organized. In 2011, the number of hospital beds was 2.7 per 1,000 residents, well below the OECD average of 4.7 per 1,000.[281]

3.16.2 Development of digital health

Digital healthcare solutions have a long history in Sweden. However, projects in this area initially started on a regional and/or local basis (the 1997 Prescription Act gave the green light to eMedication records, which only really caught on some time later) and for a long time there was no authority dedicated to the issue of digital health. It wasn't until early 2014 that a new authority was established – the Swedish Digital Health Agency (Ehälsomyndigheten). It is tasked with promoting the national IT infrastructure both with respect

281 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

to ePrescriptions and patient access to health data through the establishment of an EHR (HälsaFörMig service).[282]

The first concrete strategy in the area of digital health was published in 2006 and implemented in 2010. Its aim was to adapt legislation and regulations to reflect current trends in data processing and usage, introduce binding national standards, establish a national IT infrastructure for the exchange of health data between all regions and make health-related information available to patients.[283] All relevant legislation was amended, including the Patient Data Law (Patientdatalag (2008:355)), which is a special addition to data protection legislation which regulates the treatment of health data, and the Patient Protection Law (Patientsäkerhetslag (2010:659)), which concerns medical confidentiality, conditions for healthcare service providers and their monitoring.[284]

Figure 36 summarizes existing digital health components in Sweden identified in the course of this study (green-shaded fields).

FIGURE 36: **Map of digital health in Sweden**

Digital Health Index
Score: 68.3

Enablers: strategies, standards, institutions				
Legal framework conditions			Institutional anchoring	
Data protection regulations	Data security	Technical standards	National digital health agency	Financial ressources and incentives
Legal certainty	Medical terminology guidelines	Semantic standards	Enforcement of standards	Stakeholder engagement

Digital health infrastructure				
Universal national patient identifier	Transparent national access regulations	Provider and service registers	Technical data infrastructure	Automatic retrieval of patient data

Digital health applications					
Electronic Health Record (EHR)		Health services		Health information	Healthcare provision
Vaccinations	Medication list	EPrescription	Video consultations	Patient portal	Health system monitoring via EHR
Laboratory results	Patient access control	Online appointments		Health information portal	Health services research
Patient Summary	Structured and coded content	Telehealth			

available (two thirds of the questions answered positively)

Source: Bertelsmann Stiftung

282 Kirchberger, C. (2014). *Overview of the national laws on electronic health records in the EU Member States – National Report for Sweden.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_sweden_en.pdf.

283 Ministry of Health and Social Affairs, (2010). *National eHealth – the strategy for accessible and secure information in health and social care.* [pdf] Stockholm: Ministry of Health and Social Affairs. Available at: https://www.regeringen.se/contentassets/632b4d05795549bc98a45cc5321db1c8/national-ehealth---the-strategy-for-accessible-and-secure-information-in-health-and-social-care-s2011.023.

284 Kirchberger, C. (2014). *Overview of the national laws on electronic health records in the EU Member States – National Report for Sweden.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_sweden_en.pdf.

3.16.3 Policy activity and strategy

Digital health strategies

The current digital health strategy is called "Vision for eHealth 2025."[285] While previous strategies focused on the expansion and promotion of a wide range of different solutions and services, the 2025 vision is more concerned with interoperability and system integration of existing solutions. There are plans to standardize various private, public, regional and national systems on the principle of one patient, one record. Given the number of individual solutions, this is an extensive task.

There is a great deal of political will for cooperation and for driving digital health forward. On the one hand there are efforts to bring private suppliers to the table to discuss how to bring about technical interoperability – in EHRs, for example – and on the other, local authorities and districts are closely involved in provision of digital services. Inera AB is a privately organized company owned by the districts and local authorities. Both Inera and the Association of Swedish Pharmacies are included in the digitalization process as business sector actors.

Institutional anchoring, financing and legal framework

As well as the Digital Health Agency, there are several other authorities in Sweden concerned with digital health – the National Board of Health and Welfare (Socialstyrelsen) has passed a number of ordinances and guidelines on semantic and technical interoperability and on data protection. In 2013 the Health and Social Care Inspectorate (Inspektionen för vård och omsorg) took over the Health Ministry's responsibility for oversight in the area of digital health. Responsibility for the monitoring of digital health strategy, investment and execution of national components of digital healthcare programs lies with the Swedish eHealth Agency (eHälsomyndigheten) and the Swedish Association of Local Authorities and Regions. The Center for eHealth in Sweden (CeHis), part of Inera, cooperates on numerous projects and publishes evaluation reports. The Swedish Data Protection Authority (Datainspektionen) is the monitoring authority responsible for data protection in general and patient data in particular.

The last digital health strategy in 2010 defined a three-point interoperability framework – the national information structure (NI), national interdisciplinary terminologies (NF) and the national architecture and framework plan (NA). The NI defines the type of information that is required in health and welfare documentation at an overall level. It further describes how the information should be structured so that it can be used in different contexts, for different purposes, in the health and social care process and for monitoring and managing of activities.[286] The NF encompasses nationally agreed concepts and terms as well as international classifications. The NA for health and welfare services is concerned with detailing required solutions and how they should be structured to enable exchange of information. This requires adherence to multiple international standards. The architecture is delivered in the form of reference architectures and best practices which regulate the development of common solutions.

285 Ministry of Health and Social Affairs, (2016): *Vision for eHealth 2025 – common starting points for digitisation of social services and health care.* Stockholm.

286 Ministry of Health and Social Affairs, (2010): *National eHealth – the strategy for accessible and secure information in health and social care.* Stockholm.

The state finances the eHealth Agency through a separate budget and overall, insurers reimburse digital services much as they do traditional services. In the Stockholm region, physicians can now charge the same amount for teleconsultation via video chat as they can for practice appointments. And patients pay the same practice fee for both variations – around € 20. Guidelines currently being drafted will determine when online consultation is appropriate and when it is best avoided. In general terms, there are technical upgrades under way in over half of the districts in Sweden aimed at creating new IT systems which will then be expandable on a modular basis in the coming years.[287]

Data may be shared or processed for purposes other than healthcare as long as the original purpose of data capture does not fundamentally contradict the purpose of further usage. This means that data captured to optimize treatment processes may also be used outside the institution in which it was captured as long as there is a guarantee that this further usage will pursue the same ends.[288] The way data is transferred, secured and accessed, as well as issues of medical liability, are regulated by the Patient Data Law.[289] This and other laws were amended or expanded in the mid-2000s to create a clear legal framework in relation to digital health.

3.16.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

For patients in the Swedish healthcare system, a personal identification number in connection with an identity card forms a unique identifier, and medical professionals are also identified and authenticated through a data register, the HSA (Hälso och Sjukvårdens Adressregister). The technical security system behind it is known as SITHS. By using the SITHS ID card, providers can identify themselves regardless of organizational and geographic boundaries, and confirm their rights – access to patient data, for instance. This means that the identity and legal responsibility of the service provider is guaranteed in the transmission of patient data at all times. SITHS was successfully rolled out to all districts in 2010.[290]

While data security in Sweden generally conforms to high standards, efforts in the area of interoperability and uniform technical standards have lagged behind somewhat. A working group of the eHealth Agency is looking at this area as part of the current digital health strategy.

In 2014, the coverage of EHRs in Sweden was already at 96 percent. The EHR market is still divided between five companies, who have conceived the digital file system in a way that precludes interregional exchange altogether. Each district has its own EHR; even for a single provider, no two systems are identical, instead each one reflects the differing requirements of the districts. Sjunet, a broadband network, serves as the national system for health data exchange, and is used to transmit all medical information independently

287 himssinsights.eu, (2018). *Moving towards a holistic healthcare ecosystem.* [online] HIMSS Europe: Insights. Available at: http://www.himssinsights.eu/moving-towards-holistic-healthcare-ecosystem.

288 Kirchberger, C. (2014). *Overview of the national laws on electronic health records in the EU Member States – National Report for Sweden.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_sweden_en.pdf.

289 *Patient Data Act, Patientdatalag 2008.*

290 Eftimovska, E. (2014). *The Swedish e-Health Landscape Surrounding the SRQ Registry.* Stockholm: Karolinska Institute.

of regular internet connections.[291] The network is used for telemedicine video conferences, teleradiology, remote access to applications, database access and secure email. It can also be used for eLearning in (further) medical training of healthcare personnel.[292] This Inera-operated infrastructure is installed in all 21 districts, with functions including the ability to access the patient summary NPÖ (Nationell Patientöversikt) across sectors. This file is not directly exchanged, rather it is retrieved by physicians via a separate server.

Digital health applications and services

The ePrescription service is also linked to Sjunet. The dispatch of the prescription as well as the dispensing of the medication and confirmation thereof are all carried out electronically. In outpatient care, only the prescribing physician and the pharmacy personnel have access to the service. Other physicians – specialists, for instance – can nonetheless view a list of the patient's previous medications if this step improves treatment. Patients can collect their medication from any pharmacy in Sweden.[293]

While physicians in some districts can base their treatment solely on telemedicine services, there is no national uniform framework in this regard. The first video consultations have been implemented in the Stockholm region, otherwise telemedicine mainly occurs between physicians, who exchange diagnoses and x-ray images.[294]

The health portal 1177.se is a joint project of all Swedish districts and regions run by Inera.[295] The website offers information supplied by medical professionals covering medication, various clinical pictures and options for treatment. Through the telephone hotline 1177, which is available 24 hours a day, medical personnel are on hand to offer advice on where and at what level callers can seek treatment, if required.

A sibling platform, "My Health Contacts" (Mina Vårdkontakter), is a hub for all personalized digital services, and since 2016 it has offered the entire population access to ePrescriptions, test results, online renewal of prescriptions, appointment booking, teleconsultation and at least a view of their own electronic health record.[296] This can be retrieved from 1177.se and is called Journalen. These functions are not identical in every district.[297]

The content of the EHRs differs from district to district. Patients do have uniform rights in viewing and correcting their records; incorrect information may be reported by patients, however, they cannot change information on their own initiative. They can, however, decide which physicians have access to which information within the EHR.[298]

291 Canadian Trade Commissioner Service, (2014): *E-Health and Telehealth Sector Profile – Stockholm, Sweden.* [pdf] Available at: http://www.bioalberta.com/uploads/files/Documents/Other percent20Reports/E-Health percent20and percent20Telehealth percent20Sector percent20Profile.pdf.
292 PriceWaterhouseCoopers, (PWC), (2010): *Luxembourg Ministry of Health. eHealth Service Platform Study.*
293 Kierkegaard, P. (2013). E-Prescritption across Europe. *Health Technology*, 3(3), pp 205-219.
294 Sources: national correspondent and survey results.
295 1177.se, (2018). *Om 1177 Vårdguiden.* [online] Available at: https://www.1177.se/Om-1177/Om-1177/
296 Jakobsson, L., and Sobin, J. (2014): *eHealth development in Sweden: A study of prominent aspects and benefits from a multi-user perspective.* MD. KTH, School of Industrial Engineering and Management.
297 Joint Action to Support the eHealth network, (JASEHN), (2017): *EU State of play on patient access on eHealth data. Interim report.* JASEHN.
298 Sources: national correspondent and survey results.

The Swedish Medical Products Agency is responsible for the certification and monitoring of all apps and devices that are classified as medical products. Only in a few districts can patients use mobile devices to gain access to their health data.[299]

Data integration and exchange readiness

The National Board of Health and Welfare is concerned with developing and implementing technical and semantic standards, for which it draws on the 2010 interoperability framework. Between 50 percent and 75 percent of all physicians in Sweden are obliged to adhere to defined clinical terminology standards in documentation of health data.

Regional EHRs have low levels of interoperability – between 25 percent and 50 percent of all systems are currently able to exchange data with each other. The entire Swedish population is captured by various healthcare systems, but it is estimated that only 25 percent of all systems in Sweden are used for quality checks and performance evaluation.[300]

Sweden is one of the leading countries in Europe in the field of transnational exchange of patient data.[301] From 2019 it should be possible to exchange ePrescriptions with Finland, Portugal, Estonia and Croatia.[302]

3.16.5 Actual use of data

In Sweden, all documentation of health data is carried out digitally in all care sectors, and all facilities in all 21 districts are connected to the national digital infrastructure Sjunet and the e-service platform.[303] Outpatient-care facilities have 100 percent access to the ePrescription service while only 75 percent of hospitals are connected. Prescriptions are only issued and sent digitally.

The different regional EHRs are linked to the e-service platform, which is the only way patients in all regions have a central portal for their data. The patient summary NPÖ is also linked to the Swedish medication register. In the districts, an average of between 50 and 75 percent of all facilities are connected to a regional EHR or the NPÖ. Only 25 percent to 50 percent of hospital physicians have access to the NPÖ. For outpatient physicians and specialists, the rate is between 50 percent and 75 percent.

Health data from the NPÖ and the regional EHRs is not automatically made available for research purposes and may only be used in the interests of treatment optimization. That includes the numerous quality registries that have arisen over the last 15 years in Sweden, and which store de-identified health-related data, but only for research purposes and for monitoring of the healthcare system. The SKL (Sveriges Kommune och Landsting – Swedish Association of Local Authorities and Regions) provides access rights for research insti-

299 Barkman, C., and Weinehall, L. (2017): Policymakers and mHealth: roles and expectations, with observations from Ethiopia, Ghana and Sweden. *Global Health Action*, 10 (3).

300 Sources: national correspondent and survey results.

301 himssinsights.eu, (2018). *Prescriptions without Boundaries.* [online] HIMSS Europe: Insights. Available at: https://www.himssinsights.eu/prescriptions-without-boundaries.

302 ec.europa.eu, (2017). *Digital Single Market: Cross-border digital prescription and patient data exchange are taking off.* [online] European Commission. Available at: https://ec.europa.eu/digital-single-market/en/news/cross-border-digital-prescription-and-patient-data-exchange-are-taking.

303 inera.se, (2018). *nationella tjänsteplattformen och tjänstekontrakt.*[online] Available at: https://www.inera.se/digitalisering/infrastruktur/nationella-tjansteplattformen-och-tjanstekontrakt/.

TABLE 23: **Digitalization profile Sweden**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
■					P2	Political will to support data transfer and data exchange is advanced
	■				P3	An effective strategy to digitalise the healthcare system is in place
	■				P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
■					P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
■					P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
		■			P7	A national digital health entity has been established for oversight of digital health implementation
	■				P8	Digital health service refunding and financing is in place on the national / regional level
			■		P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
■					P10	Legal frameworks in place to protect sharing of patient data
	■				P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
■					T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
				■	T2	Sufficient security actions are in place to secure patient privacy
			■		T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
		■			T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
■					T5	EPrescription services are operational
			■		T6	Telehealth and telemedicine can be routinely used
		■			T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
	■				T8	Patient control of content and access to the EHR
		■			T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
	■				T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
		■			T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
		■			T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
	■				T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
	■				A1	Digital health applications are a dominant solution for direct patient care
■					A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
			■		A3	Level of EHR uptake is high
			■		A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
			■		A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
■					A6	For monitoring and improvement of healthcare systems health data is used regularly
		■			A7	Automatic extraction of health data from EHR systems to national databases is pervasive
	■				A8	The quality of data and clinical content of electronic records being shared among providers is high
			■		A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung

tutes and its own authorities to generate evaluation reports. There are more than 50 such registries, and each one is responsible for a different type of disease (pattern). There have long been calls for integration with the NPÖ system, but this has only been partially implemented. The Swedish Rheumatology Quality Register (SRQ) is among the most advanced with respect to integration with the EHR from the provider CompuGroup Medical, and with digital healthcare services. Through the portal "My Health Contacts," rheumatism patients in certain districts can see this data in their EHR.[304]

Bearing in mind regional differences in EHR systems, there are up to four individual databases connected to Swedish EHRs: as well as (1) data for outpatient care, there are also (2) automatic information from dental treatment, (3) diabetes registries and (4) pregnancy data.[305]

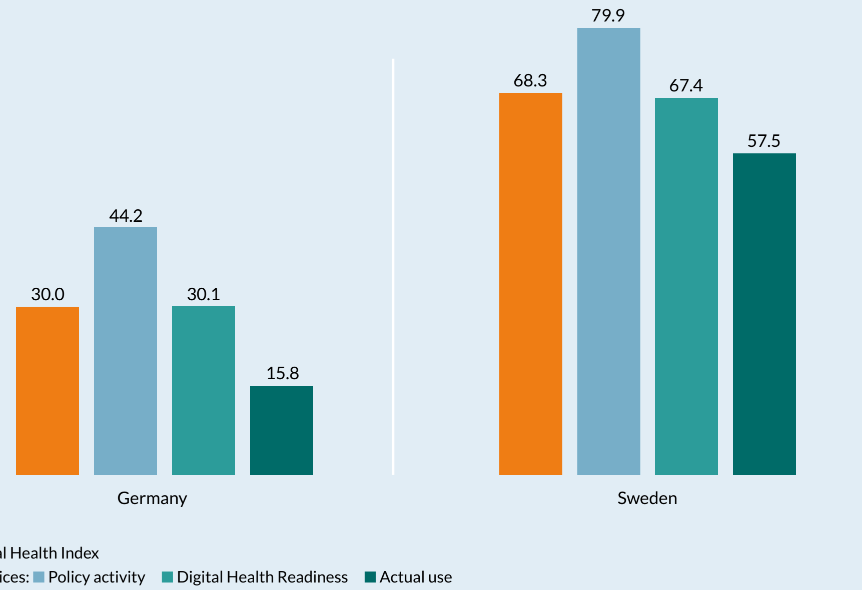
While there are no regular quality checks of the EHR systems or the NPÖ, the proportion of data entered that follows the structured, defined standards is estimated at over 75 percent.[306]

In 2017, around 25 percent to 50 percent of patients in Sweden used health portals to get treatment information or advice via the hotline.[307]

3.16.6 Digital Health Index: Comparison with Germany

When comparing Sweden and Germany's respective performance in the Digital Health Index and the three sub-indices, it is apparent that Sweden is in the clear lead in all areas. The ratio between sub-indices is similar in both countries.

FIGURE 37: **Comparison between Germany and Sweden,** in the Digital Health Index and sub-indices



Source: Bertelsmann Stiftung

304 Eftimovska, E. (2014). *The Swedish e-Health Landscape Surrounding the SRQ Registry.* Stockholm: Karolinska Institute.
305 Sources: national correspondent and survey results.
306 Sources: national correspondent and survey results.
307 Sources: national correspondent and survey results.

Switzerland
8.45 million inhabitants
41.285 km² area
204.7 inhabitants per km²
Digital Health Index
Score: 40.6
Rank 14

3.17 Switzerland

Switzerland is one of the countries that will be analyzed more closely in Part II of this publication. This country report is thus an abridged version of that analysis.

3.17.1 The national healthcare system

Service provision

Switzerland only introduced universal, comprehensive mandatory insurance in 1996, known as "obligatorische Krankenpflegeversicherung" (OKP; obligatory health insurance). Within their own cantons, those covered by the scheme can choose freely between private insurers. For the insurers – who numbered 61 in 2013 – there is an obligation to extend coverage without regard for pre-existing conditions. Switzerland's healthcare system is organized on a federal basis. The federal government is responsible for health insurance, while the cantons retain authority over the coordination of healthcare providers, including hospital planning and approval of service providers in the area of outpatient care. Consequently, the strategic development of the healthcare sector is a joint undertaking of the federal government and the cantons.

Financing

In 2015, Switzerland financed its healthcare sector at a rate of 11.5 percent of GDP, making it one of the most expensive systems in the world. One particularly striking factor is the share of supplementary payments made by patients, who fund a full 26 percent of expenditure. A pay-as-you-go system continues to differentiate between children, young adults and adults for per-capita premiums, which can vary greatly between cantons and insurers.

Care provision

Switzerland resembles Germany in that outpatient medical care is largely carried out by outpatient physicians, usually in individual practices. Patients have a fundamental right to choose their doctors, however they also have the option of registering with a practice network or physician system to receive discounts on premiums. In 2010, 46 percent of Swiss adults exercised this option. Cantons are responsible for inpatient care and operate most of the regional clinics. They finance the investment costs and 50 percent of the operating costs for hospitals.[308]

3.17.2 Development of digital health

In 2006, the Federal Council resolved to update its 1998 Strategy for an Information Society with a revised document including an additional section on eHealth,[309] and commissioned by the Federal Department of Home Affairs to prepare a Swiss eHealth strategy. Given that the federal government is responsible only for financing and framework planning and the cantons for providing the actual healthcare, there have been joint developments in the area of national eHealth from the beginning. For overarching planning and coordi-

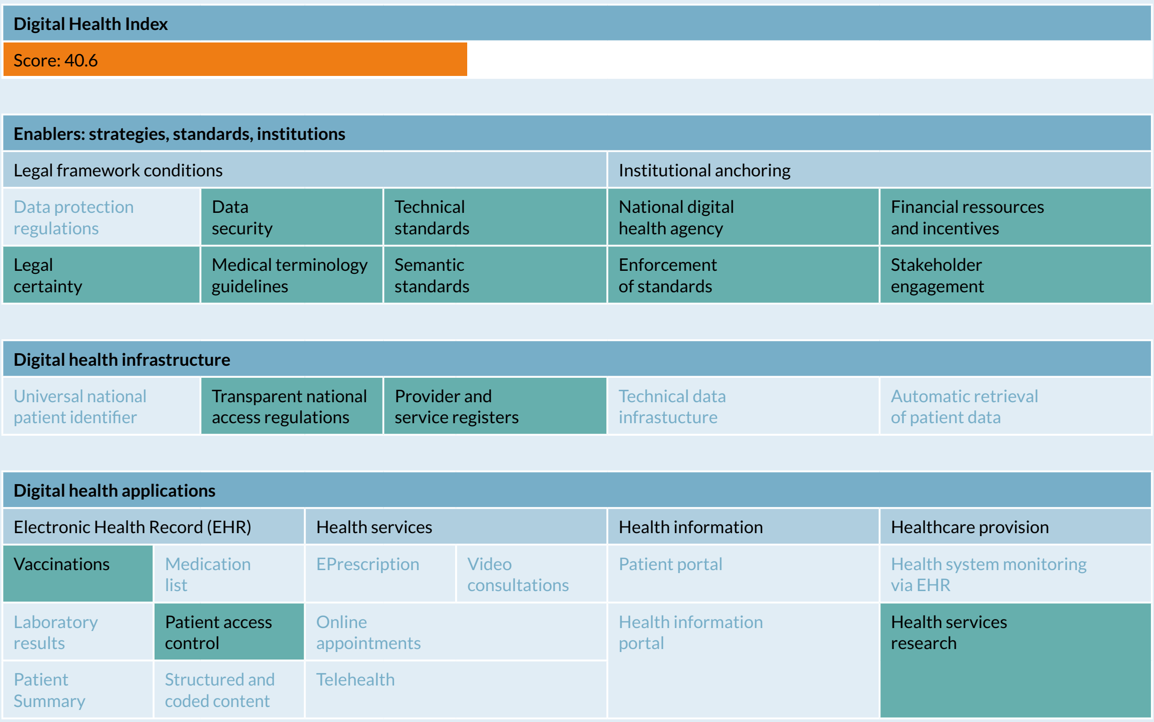
308 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.
309 *Strategie des Bundesrates für eine Informationsgesellschaft in der Schweiz 1998.*

nation, reflecting the country's heavily federal structure, the competence and coordination center "eHealth Suisse" was established under the aegis of the Health Ministry in 2008.[310] It serves as a go-between and catalyst for the managed introduction of digital healthcare solutions that adhere to certain national standards.

Initial attempts at standardizing the information systems of individual Swiss hospitals date back to 2003. The Patientendossier 2003 project pursued the objective of inter-facility treatment documentation between 1998 and 2003, as part of the UNIT program of the university hospitals of Switzerland. Efforts to standardize Swiss clinic information systems to form a common national, computer-based patient dossier – while also defining corresponding standards – were hobbled by special interests and a lack of consensus among the participating university clinics.[311]

The *Strategie eHealth Schweiz* (hereafter: Switzerland E-Health Strategy) (2007) drew lessons from the past. Its aim was to have the federal government recommend uniform semantic and technical standards which would then be implemented by the cantons. Online services, particularly eMedication and ePrescriptions, were identified as future-ready solutions which would increase efficiency and improve care. To this end six sub-projects were launched

FIGURE 38: **Map of digital health in Switzerland**



available (two thirds of the questions answered positively)
Source: Bertelsmann Stiftung

310 Bundesamt für Gesundheit, (BAG), (2007). Strategie "eHealth" Schweiz. [pdf] Köniz: Bundesamt für Gesundheit. Available at: https://www.bag.admin.ch/bag/de/home/themen/strategien-politik/nationale-gesundheitsstrategien/strategie-ehealth-schweiz.html.
311 Bundesamt für Gesundheit, (BAG), (2007). *Strategie "eHealth" Schweiz.* [pdf] Köniz: Bundesamt für Gesundheit. Available at: https://www.bag.admin.ch/bag/de/home/themen/strategien-politik/nationale-gesundheitsstrategien/strategie-ehealth-schweiz.html.

covering standards, technical architecture, pilot projects, legal foundations, financing and qualifications (specifically, digital health literacy). Each project has a defined duration and objectives, such as the introduction of the electronic patient dossier (EPD) in 2015, which nonetheless only became operational in mid-2018.

In June 2015 the Federal Law on the Electronic Patient Dossier was passed. eHealth Suisse proposed four exchange formats for standardization of data on the EPD, and supported implementation. This included an electronic vaccination certificate and electronic laboratory results.

Figure 38 summarizes existing digital health components in Switzerland identified in the course of this study (green-shaded fields).

3.17.3 Policy activity and strategy

Digital health strategies

With the start of the action plan Digital Switzerland, the Federal Council issued the order for a Switzerland E-Health Strategy 2.0 in April 2016.[312] The Swiss Conference of the Cantonal Ministers of Public Health (GDK) supported the plan and a working group made up of representatives of the federal government and the cantons developed a draft successor strategy for the period 2018 to 2022. This Strategy 2.0 was approved in early 2018 by the GDK and the Swiss Plenary Assembly and issued on 1 March. Specific measures for reaching objectives will be developed by the relevant actors until the end of 2018.[313]

Healthcare policy is essentially decided between the cantons, the medical profession and the federal government, and with each pursuing their own interests, it is easy to see why implementation processes can take so long. Driving digitalization of the healthcare system will require political measures, negotiation with the different actors in the healthcare system and in particular legislative amendments, with technical implementation issues receding to the background. Switzerland does not have a health minister, which is why the Federal Office of Public Health itself generally expends few resources on digital health.

Switzerland's digitalization efforts have tended to focus more on a national electronic health record and regional health information portals. To enable healthcare service providers organized at the cantonal level to exchange data with each other, Switzerland E-Health Strategy 2.0 also defines more detailed measures for an interoperable digital healthcare system. Both for the EHR and the development of the regional health information portals, lawmakers have defined initiation plans, implementation assistance and sanctions for non-compliance with these plans. The economic impact of a country-wide EHR (here: electronic patient dossier, EPD) has been evaluated twice on the basis of initial draft legislation, setting out the positive influence this would have on the quality of care.[314]

312 Bundesamt für Kommunikation, (BAKOM), (2016). *Strategie Digitale Schweiz.* Biel.
313 eHealth Suisse, (2018). *Strategie eHealth Schweiz 2.0 2018-2022.* [pdf] eHealth Suisse Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180214_Strategie_eHealth_2.0_Version_Dialog_NGP_d.pdf.
314 empirica, (2013). *Regulierungsfolgenabschätzung zum Entwurf des Bundesgesetzes über das elektronische Patientendossier.* Bern.

Institutional anchoring, financing and legal framework

The Swiss government is offering the cantons co-financing in the amount of CHF 30 million for the introduction of an EPD. The condition attached to this state support is that the cantons match this with a further CHF 30 million. These funds are earmarked, meaning that they can only be used for the establishment of "EPD communities." Technical upgrades in hospitals cannot be funded from this pot.[315]

The EPD communities can be established on a decentralized basis in the care regions, for instance within a canton or across multiple cantons. A community may include all healthcare professionals and their facilities, meaning hospitals, care homes, medical practices, pharmacies and Spitex services. They are organized as technical associations which coordinate and secure the introduction of EPDs in the care region. In some EPD communities, patients are able to open their personal EPDs. These EPD communities are known as "EPD eHealth communities." eHealth communities must offer a patient access portal so that patients can see their EPD and manage the access rights of healthcare professionals to their documents. Patients are free to choose where they wish to open their EPD, and switch eHealth communities at any time.[316]

eHealth Suisse is Switzerland's coordinating body for the introduction of the EPD and is funded by the federal government[317] and the cantons[318] in equal measure. In the past, the organization cooperated on the creation of a new legislative framework and played a central part in getting the Federal Law on the Electronic Patient Dossier passed in 2015. The framework law is intended to provide investment security while at the same time enabling sufficient flexibility of implementation in the care regions. The ordinance on the EPD handed down in 2016 also regulates levels of confidentiality and access rights, provisions on the issuance and administration of patient identification numbers, certification requirements for (eHealth) communities and means of identifying patients and physicians. For outpatient physicians, pharmacies or residential care organizations, admission to a community is voluntary. Hospitals, on the other hand, must join a certified community within three years of the law coming into effect. This period is extended to five years for long-term care facilities and birthing centers.[319]

Since the EDPG came into effect in 2017, eHealth Suisse has also assumed an enforcement role in the areas of certification, standards, interoperability – in cooperation with the cantons – and public communications. The areas of responsibility are governed by the eHealth Framework Agreement between the Department of Home Affairs and the Conference of Cantonal Ministers of Public Health.[320] To date, however, only non-binding recommendations have been passed down to the cantons. In the future, the organization also aims to be a catalyst in the area of mHealth.

315 CURAVIVA, (2014). *Strategie eHealth Suisse/ Elektron. Patientendossier. Ziele und Umsetzung – Erkenntnisse – Handlungsbedarf.* [pdf] Bern: CURAVIVA Schweiz. Available at: https://www.curaviva.ch/files/R3VJU8A/Ziele-Umsetzung-Erkenntisse-und-Handlungsbedarf-von-eHealth.pdf.
316 eHealth Suisse, (2017). *Strategie eHealth Schweiz 2.0 2018-2022. 2nd ed.* [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/171213_eHealth-Leitfaden-fuer-Bildungsverantwortliche_d.pdf.
317 Eidgenössisches Department des Innern (EDI)
318 Gesundheitsdirektorinnen und –direktoren Konferenz (GDK) der Schweizer Kantone
319 Bundesamt für Gesundheit, (2016). *Erläuterungen zur Verordnung über das elektronische Patientendossier (EPDV).* Bern.
320 *Rahmenvereinbarung über die Zusammenarbeit im Bereich eHealth (eHealth Vereinbarung) 2017.*

To date, there has been no public budget for digital health. All eHealth Suisse activities are financed by the federal government and the cantons. For the introduction and operations of the EPD, healthcare service providers must commit a part of their budget and can get financial support for their EPD community. As well as co-financing for the communities, the hospitals are subject to penalties if they do not adhere to implementation timetables.

Patient data from the EPD can be processed further for both clinical studies and public statistics. The form of processing is not specifically regulated. Currently there is no law that explicitly defines the medical liability of digital healthcare services for patient security and quality of care on the basis of data quality standards. Most universities and colleges that focus on healthcare professions already train students in general use of electronic health records.[321]

3.17.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

The Central Compensation Office (ZAS) is responsible for issuing and managing patient identification numbers. ZAS generates these numbers for patients when their electronic patient dossier is set up by the eHealth community and managed in the community's patient master index. This number is a part of two-factor authentication for identification required for exchanging data between facilities and allowing access by physicians. The patient identification number can only be used with the EPD and is not intended for regular care. Only physicians who are authenticated via a database with their professional ID can gain access to patient data.[322]

eHealth Suisse explicitly defines the security provisions that must be followed to protect patient data. The cantons and/or the communities can decide for themselves which IT systems they wish to use, as long as they fulfill the provisions.[323] For protection of privacy, patients have the right to decide which physician has access to their EPD. Healthcare facilities can have their personnel take advantage of training in handling sensitive data, organized by their community.

There is no consistent interoperability strategy for the EPD. Within eHealth Suisse, various working groups have addressed the areas of semantics, exchange formats, standards and technical-semantic integration, and issued corresponding recommendations and provisions over the years. These relate to the overall architecture of the EPD as well as individual functions or areas. As such, there is no uniform framework for terminology and semantics.

321 Sources: national correspondent and survey results.
322 eHealth Suisse, (2017). *Arbeitsgruppe technisch-semantische Integration EPD.* Bern: eHealth Suisse.
323 Bag.admin.ch, (2018). *Elektronische Identität.* [online] Bundesamt für Gesundheit, (BAG). Available at: https://www.bag.admin.ch/bag/de/home/themen/strategien-politik/nationale-gesundheitsstrategien/strategie-ehealth-schweiz/umsetzung-vollzug/elektronische-identitaet.html.

The EPD is currently in a national launch phase in the area of inpatient care. The cantons can decide how quickly they wish to put these projects in practice and currently more than half of the cantons have reported evaluated projects in the context of the electronic patient dossier to the coordinating body, eHealth Suisse.[324] More than half of the cantons are still in the planning phase.

Digital health applications and services

There is currently no ePrescription service in Switzerland, and the use of telemedicine is subject to a high degree of regional variation. While physicians may base their treatment solely on remote diagnosis, it is an option that is rarely exercised. A patient can consult a physician by email and physicians may exchange findings or diagnoses with each other – to get a second opinion, for instance.

To date, none of the digital healthcare solutions have proceeded beyond the introduction phase. Implementation only began in 2018. In the future, patients will have unrestricted access to their health information. Throughout 2018/19, the first communities will be implementing the EPD. The electronic vaccination dossier (eImpfdossier) has been available complete with technical and semantic requirements in a suitable exchange format since 2014. Patients themselves can generate this online and, by using a special tool, check what vaccinations they currently require and which ones they need to catch up on. It is also possible to grant physicians and pharmacists access to the eImpfdossier.[325]

eHealth Suisse offers two forms of information and training materials for the general population and for healthcare professionals. The brochure "Guidelines for Training Managers" is designed as a tool for lecturers in colleges and training institutions which helps them acquaint the personnel of the future with the issue of electronic health in general and the EPD in particular. An eLearning platform with general information on the EPD is being set up on the eHealth Suisse homepage. With actual implementation differing from canton to canton, they share responsibility for the actual services on offer with the communities.[326] Since December 2017, an eLearning course has been available at the University Hospital of Basel, and it is targeted at project managers and anyone else involved in introducing the EPD in Swiss hospitals.[327]

To date, there is no state-funded or operated health information portal in Switzerland. Patients must go to various different websites of the insurers and healthcare organizations to get information on specific illnesses. As part of the introduction of the EPD and the communities, in future there will be corresponding portals that will allow patients to see their patient dossiers. For now, they can only apply for changes if a physician has entered certain data incorrectly.

324 Schweizerische Konferenz der kantonalen Gesundheitsdirektorinnen und –direktoren, (GDK), (2018). *Elektronisches Patientendossier (EPD) – Aktivitäten in den Kantonen.* [pdf] Bern: Scweizerische Konferenz kantonalen Gesundheitsdirektorinnen und –direktoren (GDK). Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180508_Stand_eHealth_In_den_Kantonen_def_d.pdf.
325 Meinimpfungen.ch, (2018). *Der schweizerische elektronische Impfausweis.* [online] Stiftung Meinimpfungen. Available at: https://www.meineimpfungen.ch/about.html.
326 Berner Fachhochschule (2017). *Konzept eLearning-Angebot zum elektronischen Patientendossier EPD. eLearning bei der Umsetzung des EPD.* [pdf] Bern. Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/170912_Konzept_eLearning-Angebot_EPD_def_d.pdf.
327 Easylearn.ch, (2018). *Neues e-Learning zum elektronischen Patientendossier (EPD) und wie Sie Ihr Spital daran anschliessen.* [online] easylearn. Available at: http://www.easylearn.ch/news/641-sue-fuehren-sie-das-elektronische-patientendossier-epd-erfolgreich-ein.html.

To date, there has been no coordinated scope for action in the area of mHealth. The organization swissmedic is responsible for certification and oversight of health applications.

Data integration and exchange readiness

Since the eHealth Framework Agreement came into effect, all standards and specifications issued by eHealth Suisse are binding. Healthcare service providers in an inpatient context must also adhere to a uniform catalog of terminology and coding systems so that all future data is documented in the EPD in a structured way. A 2015 report provided more detailed specifications for uniform processes and procedures for semantic and technical interoperability. This represents an update to older recommendations and primarily governs the definition of metadata in the EPD.[328] Another report concentrates on the underlying technology of the electronic vaccination dossier within the EPD.[329] Generally only international standards (HL7 CDA, SNOMED ICT and IHE PCC) are applied, so that foreign facilities can also use information, as part of "Connecting Europe Facility," for instance.[330]

The town of Köniz near Bern hosted an EPD projectathon between 25 and 29 September 2017, at which over 100 IT specialists from the industry were able to check the compatibility of their systems and programs with the EPD in 251 tests. Of these, independent observers marked 159 as "passed." Organizers eHealth Suisse, IHE Suisse and Federal Office of Public Health are evaluating the experience in detail and planning further steps. Errors discovered in specifications or differing implementations by providers which require clarification will flow into the first revision of the EPD Implementation Law. The next projectathon is planned for September 2018. This event serves to test the statutory requirements of private providers and to ensure seamless implementation in the cantons as far as possible.[331]

With step-by-step national implementation ongoing, there are only a few, unstructured documents exchanged in the EPD. In regions bordering EU member states, pilot projects for cross-border data exchange are under way thanks to dedicated legislation on the issue.

3.17.5 Actual use of data

To date, very few hospitals have joined an EPD community and in outpatient care, too, general practitioners are keeping the EPD at bay for now, especially as they are not obliged to introduce it. Current conditions therefore only allow restricted digital exchange of clinical information. In the area of inpatient care, at least, every hospital will be obliged to introduce the EPD by 2020. Only then will it be possible for patients to retrieve their personal health information through an internet portal too.

328 eHealth Suisse, (2015): *EPD – Metadaten Definitionsprozess und erstes „Startset".* [pdf] Bern. Available at: http://docplayer.org/22318270-Ehealth-suisse-epd-metadaten-definitionsprozess-und-erstes-startset.html.
329 eHealth Suisse, (2015): *Austauschformat Elektronisches Impfdossier.* 2nd Ed. Bern.
330 eHealth Suisse, (2015): *Project Report Cross Border eHealth Information Services.* [pdf] Liebefeld. Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/Project_report_CBeHIS_jan-june2017_-_HUG___HEG.pdf.
331 eHealth Suisse (2018): *Bericht EPD-Projectathon 2017.* [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180328_Reportage_EPD-Projectathon-2017_d.pdf.

TABLE 24: **Digitalization profile Switzerland**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
■					P1	Digital health is an integral part of general health policy
		■			P2	Political will to support data transfer and data exchange is advanced
		■			P3	An effective strategy to digitalise the healthcare system is in place
		■			P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
	■				P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
		■			P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
		■			P7	A national digital health entity has been established for oversight of digital health implementation
	■				P8	Digital health service refunding and financing is in place on the national / regional level
			■		P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
		■			P10	Legal frameworks in place to protect sharing of patient data
		■			P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
		■			P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
		■			T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
	■				T2	Sufficient security actions are in place to secure patient privacy
				■	T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
			■		T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
				■	T5	EPrescription services are operational
			■		T6	Telehealth and telemedicine can be routinely used
				■	T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
			■		T8	Patient control of content and access to the EHR
				■	T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
■					T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
		■			T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
			■		T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
	■				T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
				■	A1	Digital health applications are a dominant solution for direct patient care
				■	A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
				■	A3	Level of EHR uptake is high
				■	A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
				■	A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
		■			A6	For monitoring and improvement of healthcare systems health data is used regularly
				■	A7	Automatic extraction of health data from EHR systems to national databases is pervasive
				■	A8	The quality of data and clinical content of electronic records being shared among providers is high
				■	A9	Patient portals offering access to personal healthcare information are highly frequented

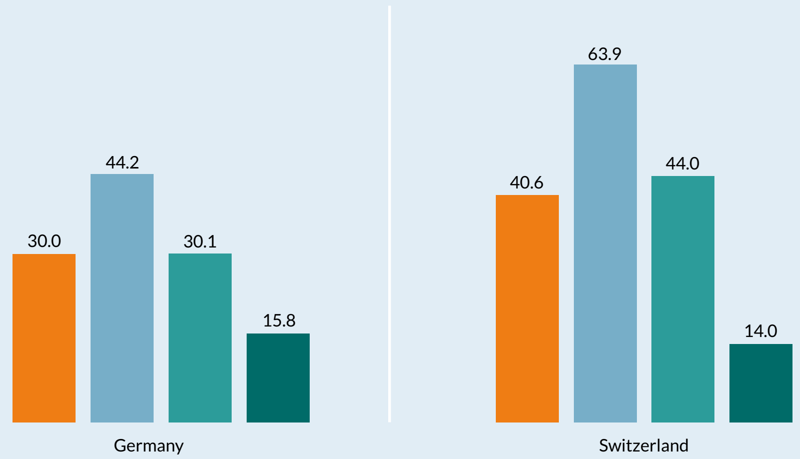
■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung

3.17.6 Digital Health Index: Comparison with Germany

The comparison between Switzerland and Germany reveals a very similar picture in both countries, with policy activity being the highest scoring sub-index by a considerable degree, and data usage falling below all other indices. In almost every area Switzerland performs marginally better than Germany; only in the area of actual use of data does Germany score slightly higher.

FIGURE 39: **Comparison between Germany and Switzerland,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity, Digital Health Readiness, Actual use
Source: Bertelsmann Stiftung


Spain
46.44 million inhabitants
505,970 km² area
91.8 inhabitants per km²
Digital Health Index
Score: 71.4
Rank 5

3.18 Spain

3.18.1 The national healthcare system

Service provision

Since the 1980s, Spain has had a universal public healthcare service which from 2002 has been entirely planned and executed at the regional level. The 17 regions gained financial autonomy in 2009 and since then have been able to raise their own taxes to finance the system. The central Spanish state's function is now limited to coordination between the regions, the creation of a service catalog and medication policy. Employees in public service additionally have a supplementary care system which offers some privileges in medical care.

Financing

Financing occurs through fiscally financed allocations from the state to the regions. They, in turn, use funds from their own various regional tax coffers. There is no earmarked healthcare tax, merely a few specifications that provide information on the amount of funding the healthcare system should receive. In 2015, overall health expenditure amounted to 9.2 percent of GDP, slightly below the EU average.

Care provision

Spanish patients generally go to a local public health center to see a general practitioner, who is employed by the regional healthcare service. Theoretically, this physician serves as a gatekeeper by organizing referral to outpatient care, but most patients circumvent this and will often have themselves admitted to hospital through the emergency room. Around 40 percent of hospitals are in public hands, with the rest maintained by local authorities, private companies and charitable associations.[332]

3.18.2 Development of digital health

The federal, decentralized structure of Spain's healthcare system means that any form of national initiative requires agreement between the central government and the regions within the forum of the Interterritorial Council of the Spanish National Health Service (Consejo Inter-territorial del Sistema Nacional de Salud, CISNS). The need for a minimum electronic dataset of health-related data to be used and exchanged throughout the regions was recognized as early as 2002. However, this idea was only decided upon in 2010, and even then, it was non-binding.

Since 2000, Spain has introduced three plans for national e-government strategies, which include key health and digital health themes. The most recent plan, Avanza 2 (2009-2015), aimed at consolidating usage of ICT in strategic sectors. This plan included the most significant changes to the healthcare system to date. It described, for instance, a nationwide implementation of patient summaries, ePrescriptions, a system for booking appointments

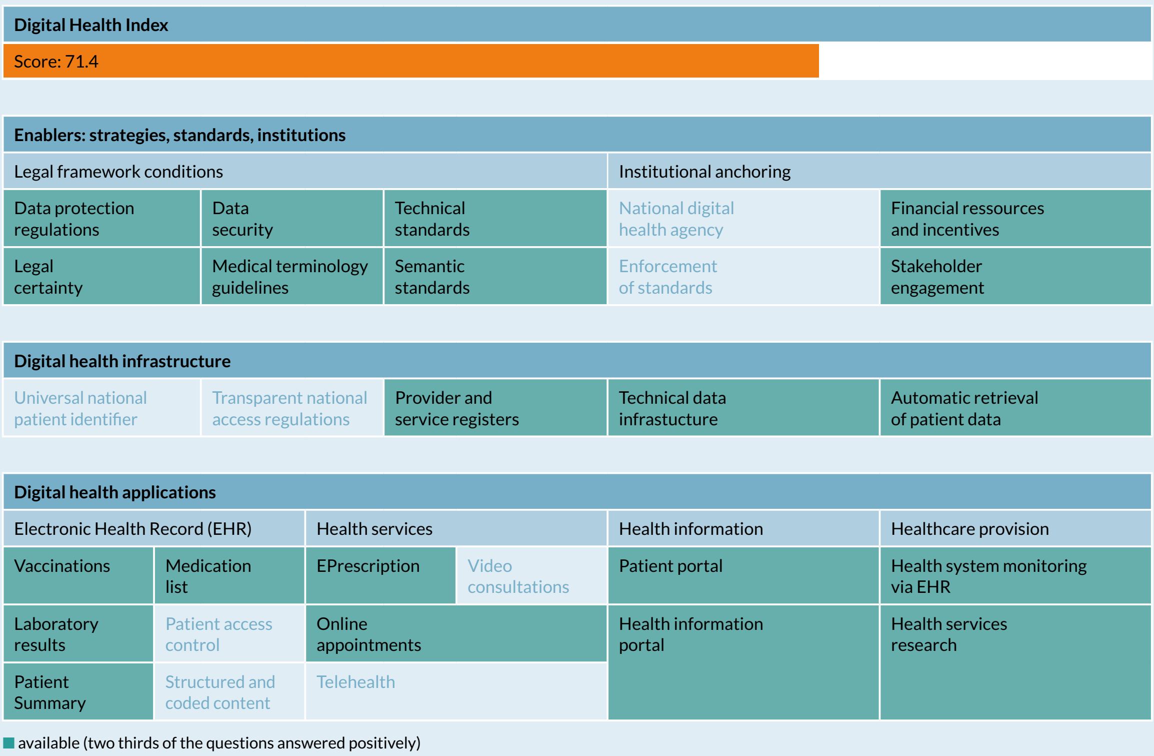
332 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd Ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

and the introduction of patient portals. While there has been an agreement to focus on interoperability between the different regional systems, to date this has not been completely implemented. The budget for the period covered was €196 million.[333]

Since 2015, there has been no uniform national strategy for the digital health sector, which has fallen victim to ongoing economic and government crises. The Digital Agenda for Europe 2015-2020 has served as a guideline for further development since that time. The decentralized system and the number of participating actors has hampered efficient implementation. Nonetheless, in early 2017 former Health Minister Dolors Montserrat started working more closely with regional actors to drive a State Pact for Health (Pacto de Estado por la Sanidad). While 77 percent of all Spaniards have an electronic medical record, usage is effectively restricted to their region of residence. This also restricts usage of the electronic health record, which remains unable to share its information with other regions. Attempts to make the system interoperable date back to 2009.[334]

Figure 40 summarizes existing digital health components in Spain identified in the course of this study (green-shaded fields).

FIGURE 40: **Map of digital health in Spain**



Source: Bertelsmann Stiftung

333 Gobierno de España, Ministerio de Industria, Energía y Turismo, (2013). *Digital Agenda for Spain.* [pdf] Available at: http://www.agendadigital.gob.es/digital-agenda/Documents/digital-agenda-for-spain.pdf.
334 De Benito, E. (2017). *Solo cinco comunidades han interconectado la receta electrónica.* [online] El Pais. Available at: http://politica.elpais.com/politica/2017/02/23/actualidad/1487862351_447695.html.

3.18.3 Policy activity and strategy

Digital health strategies

Spain's digital healthcare strategy is not chiefly focused on developing and improving the digital healthcare service in its current state. There have been successful efforts toward digitalization and implementation of digital services in the healthcare sector at the regional level. At the national level the primary focus is on making existing datasets and registries more uniform so that the data collected in the various regions can be made available to healthcare service providers nationally. Consequently, the authorities are currently concentrating on the development of a common EHR system for the entire country and the integration of services such as ePrescription. Here the current strategy is more a project in itself than an attempt to consider digital health as a part of national healthcare. At the political level there has been a lot of enthusiasm and public affirmation for digital health, but little commitment to change beyond that.

Spain has made progress in the implementation of new digital solutions at the regional level. Most regions have already developed and implemented ePrescription services and public patient portals. There are no uniform national plans, as the central government can only provide framework conditions that must be independently implemented by the regions. The specific strategy for semantics and interoperability are seen as part of Spain's digital healthcare strategy, which primarily addresses EHRs and ePrescriptions. For the planning phase, involvement by representatives of patients and physicians varied greatly across the regions. Private sector actors have only been involved in public tenders. While time-specific objectives for the implementation of regional ePrescription, EHR systems and patient portals were agreed by the regions and the Health Ministry, these are not legally binding.

Institutional anchoring, financing and legal framework

In Spain there are national and regional budgets for the development of digital healthcare infrastructure as well as the national strategy for semantic interoperability covering digital healthcare services currently in development. However, to date there is no national authority to support this process and regulate the market for digital healthcare solutions or to monitor and coordinate key strategic activities. The regions each have their own authorities for these functions.

The national healthcare service organizes and finances the implementation of regional digital healthcare systems but does not provide funding for reimbursement and routine financing. Healthcare service providers receive no payment for the extra work required for acquainting themselves with new technologies. Funding from the regional infrastructure programs is used for the development and expansion of health information networks and in most regions, healthcare professionals can attend courses to help them identify and adapt to changes that new digital services bring to their day-to-day work processes.

The general data protection regulations apply to the storage and exchange of patient-related data. A 2010 law concerning the national interoperability framework requires national security framework regulations to be applied in safeguarding storage of electronic documents. Information systems are required to undergo biannual checks to evaluate compliance with security framework requirements. Spanish legal provisions do not require the express consent of the patient for the creation of an electronic health record, for access by physicians or for joint usage with physicians in different regions or countries.[335] This is based on an understanding that patients grant their implicit consent in the act of seeking consultation from a physician. Medical liability in relation to malpractice and the use of medical products and EHRs have not been defined by lawmakers.[336] Further processing of patient-related data by third parties is governed by the General Data Protection Regulation and other EU guidelines, as well as national regulations. However, patients must give explicit consent for their data to be used for research purposes.

3.18.4 Technical implementation and readiness

Technical implementation: Infrastructure and administration

Spain has introduced a national electronic identification system for the use of EHRs and insurance services. Every citizen in Spain has an electronic medical record which stores a basic administrative dataset. The patient is identified with an individual number on visiting their general practitioner or a hospital, and there is a check to ensure that the correct file is retrieved in the respective electronic system. However, 77 percent of all healthcare cards can only be used within the region in which the bearer resides. Since 2009 there have been attempts to improve this system and the interregional compatibility of health information.

Patient data management services have a high degree of digital functionality with respect to data protection, security and processing, but under present conditions there is no facility for individual patients to determine who can and cannot access their personal data.

Spain is currently in the midst of increased national efforts to have the regions assume responsibility for adopting international standards of health IT in relation to the coding, storage and use of data. Corresponding standards are applied in all regions, although not to the same extent.

Each of the Spanish regions has an electronic health record from which a legally defined minimum dataset is automatically extracted in the form of the Historia Clinica Digital Sistema Nacional de Salud, a patient summary that can be exchanged nationally. The EHR systems can interact with national health registries for the coordination of healthcare for chronic diseases, for instance. Catalonia, Andalusia, the Basque Country and Valencia are particular pioneers in this field.

Digital health applications and services

ePrescription services are only available regionally. Both the prescription and the dispensing information are electronically documented and transmitted to the physician. Telemedicine services are only available to patients in a few regions to date. More common are peer-to-peer solutions in which physicians exchange diagnoses and x-ray images. The first pilot projects for remote monitoring of certain chronic patient groups have been introduced in Andalusia for regional implementation.[337]

335 Ballesteros, M. (2014). *Overview of the national laws on electronic health records in the EU Member States – National Report for Sweden.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_spain_en.pdf.

336 These can include: misdiagnoses, treatment errors, documentation errors, insufficiently informing patients, and mistakes relating to the division of labor between different physicians.

337 Sources: national correspondent and survey results.

Overall, almost every region in Spain has some form of health information portal which allows access to quality-assured health information, and in a few cases also allows access to the patient's own electronic health record. Appointments with physicians can largely be booked online. However, awareness of health information portals among the population is relatively low.

Patients' right of access to regional EHRs does not extend beyond the right to view them. Stored information cannot be corrected and there is no facility for restricting access by physicians.

At the national level there is no authority that is responsible for the quality and security of the digital services offered in the healthcare sector. However, at the regional level you will find some positive models, such as Andalusia, where regulatory activities are clearly defined and institutionalized. Access to digital services via mobile applications is highly fragmented across the regions and there are no national centralization efforts aimed at standardizing this. Patients who wish to retrieve their regional EHR through their cell phones can generally only do this through secured access.[338]

Data integration and exchange readiness

The regulatory authority responsible for the dissemination and promotion of international clinical terminology guidelines is Aenor.[339] However it has only been accorded the relatively minor function of promoting standards, with no power to impose them as binding. The national and regional health ministries are tasked with supporting and training medical professionals in the use of the correct terminology for digital healthcare services.

Spain has sound, well-established practices in the area of health terminology. More than 75 percent of all medical professionals and healthcare facilities that use EHR systems are obliged to comply with uniform terminology guidelines. Between 50 percent and 75 percent of regional datasets are based on uniform standards for clinical codes and terminologies.

System integration and interoperability of regional and national datasets are well developed – more than 75 percent of national datasets draw their data automatically from regional EHRs. The information is aggregated and de-identified so that it can be summarized into performance indicators and used for healthcare system monitoring.

As part of the epSOS project, national and regional ministries took part in cross-border data exchange activities, but apart from a few specific, time-limited agreements with other countries, there are no further data exchange agreements at the international level. However, there are plans to expand trans-European data traffic in the healthcare sector in the future.

338 Garcia-Armesto, S., Begoña Abadia-Taira, M., Hernandez-Quevedo, C. and Bernal-Delgado, E. (2010). Spain. Health system review. *Health Systems in Transition.* 2010, 12 (4). Available at: http://www.euro.who.int/__data/assets/pdf_file/0004/128830/e94549.pdf.

339 See footnote 334.

3.18.5 Actual use of data

More than 75 percent of all medical professionals and service providers, including hospitals and pharmacies, are linked to a regional EHR system and capture health data electronically. At the same time, 25 percent of providers offer telemedicine services, but the proportion of ePrescriptions is between 50 percent and 75 percent.[340]

More than 75 percent of primary, secondary and tertiary long-term care facilities at the national level use the regional EHR systems. They are linked to the databases of

- laboratory information systems
- imaging archive systems
- a vaccination system

The level of exchange of health information is relatively low – fewer than 25 percent of general practitioners exchange patient data with each other, and between 25 percent and 50 percent exchange information with hospitals and other specialists, but primarily to access lab and hospital reports.[341]

Health data is also gathered for public-health monitoring and for research purposes. Only in explicitly defined cases can anonymized data be used in this way, and this is subject to approval proceedings before a special committee. Publicly financed research projects do not receive access to health data from the regional EHR systems. Health data is an important information source for evaluating the overall quality and performance of the system. Consequently, more than ten datasets are fed by aggregated patient data at the national level and used for quality assessment of the healthcare sector. Examples include:

- cancer registry data
- diabetes registry data
- cardiovascular registry data
- medication and prescription information
- and administrative data registries

Automatic transfer of this information is only possible in those few regions with advanced digital capacities, such as Andalusia, Valencia and the Basque Country.

The volume of structured and coded data that is based on terminology standards and digitally documented by physicians is between 25 percent and 50 percent, although more than 75 percent of all Spanish healthcare facilities have introduced formally defined standards.[342] This requires regular training to raise awareness among healthcare personnel and improve data quality. Quality control of electronic records is carried out within the service facilities, that is, in the hospitals.

340 Sources: national correspondent and survey results.
341 Sources: national correspondent and survey results.
342 Sources: national correspondent and survey results.

Leaving aside the generally positive (regional) system integration of digital healthcare services, fewer than 25 percent of patients throughout country are able to view their personal health data through health information portals. Overall, patient usage of portals for gaining information is below 25 percent. At the same time, around 50–75 percent of the

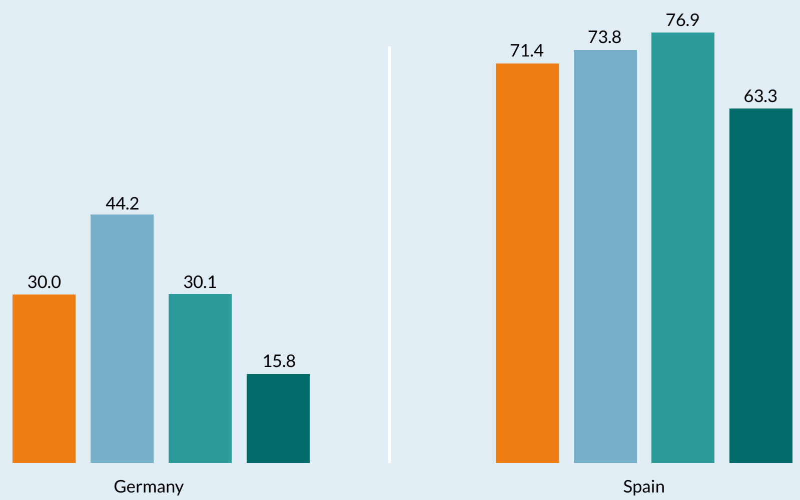
patients who received treatment over the last year visited one of the regional health information portals.[343]

3.18.6 Digital Health Index: Comparison with Germany

When comparing the relative scores of Spain and Germany, it is clear that Spain fares better in all indices. However, on a closer view of the three sub-indices, it is apparent that Germany performs best in policy activity, Spain in digital health readiness. In Spain there is also less variation between the three sub-indices.

The following chapter (chapter 4) presents the four key benchmarking results and the country rankings, which are derived from the findings of the Digital Health Index that was developed for this study.

FIGURE 41: **Comparison between Germany and Spain,** in the Digital Health Index and sub-indices



Digital Health Index
Sub-indices: Policy activity Digital Health Readiness Actual use
Source: Bertelsmann Stiftung

343 Sources: national correspondent and survey results.

TABLE 25: **Digitalization profile Spain**

Fully	Almost fully	Partly	To some extent	Does not apply		
						Policy activity and strategy
						Digital health strategies
	■				P1	Digital health is an integral part of general health policy
■					P2	Political will to support data transfer and data exchange is advanced
■					P3	An effective strategy to digitalise the healthcare system is in place
		■			P4	Clear guidelines and timelines have been established to plan and implement digital health solutions
	■				P5	Governmental institutions and key healthcare stakeholders are cooperating in digital health planning and implementation
						Digital health policy's institutional backing, financing, and legal framework conditions
	■				P6	National and regional-level financing of implementation and operation of digital health applications and services is sustainable
				■	P7	A national digital health entity has been established for oversight of digital health implementation
		■			P8	Digital health service refunding and financing is in place on the national / regional level
	■				P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services
		■			P10	Legal frameworks in place to protect sharing of patient data
		■			P11	National or regional legislative frameworks allow for comprehensive and privacy-protective secondary use of health data
■					P12	Capacity-building measures are in place for digital skills and human resource development
						Technical implementation and readiness for data integration and use
						Implementation: Infrastructure and administration
	■				T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients
■					T2	Sufficient security actions are in place to secure patient privacy
■					T3	ICT standardisation and health informatics efforts are institutionalised through a national entity
	■				T4	Patient summary and electronic health record (EHR) systems are implemented
						Maturity of digital health applications and services
■					T5	EPrescription services are operational
		■			T6	Telehealth and telemedicine can be routinely used
		■			T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care
			■		T8	Patient control of content and access to the EHR
			■		T9	mHealth and mobile applications contribute to routine healthcare delivery
						Readiness for data use and exchange: Technical and semantic interoperability
■					T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications
	■				T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country
■					T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement
		■			T13	Patient data can be transferred securely and automatically to trans-national data networks *(e.g. the EU Connected Europe Facility [CEF])*
						Actual use of data
		■			A1	Digital health applications are a dominant solution for direct patient care
	■				A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing
		■			A3	Level of EHR uptake is high
			■		A4	The use of primary and secondary data is used to enhance medical care and consultation by GPs and in hospitals
		■			A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances
■					A6	For monitoring and improvement of healthcare systems health data is used regularly
		■			A7	Automatic extraction of health data from EHR systems to national databases is pervasive
	■				A8	The quality of data and clinical content of electronic records being shared among providers is high
			■		A9	Patient portals offering access to personal healthcare information are highly frequented

■ Fully ■ Almost fully ■ Partly ■ To some extent ■ Does not apply

Source: Bertelsmann Stiftung

4 Benchmarking results

To a certain extent, the preceding chapter 3, with its empirical density, breadth of analysis and summary of the state of digitalization in 17 individual countries, forms the heart of this report. That chapter also performed an initial comparative international classification, even if only by comparing each country with the state of digitalization measured in Germany. The actual Digital Health Index and its results in the form of a variety of country rankings now follows in the current chapter 4, which also offers a conclusion and the central presentation of Part I of the overall study by summarizing the benchmarking results and presenting them in a cross-national graphical form.

Given the nature of this approach, there will be few additional empirical details provided on the countries included in this chapter's macro-perspective comparison. Detailed information about each country can be found in the country reports in chapter 3.

4.1 Digital Health Index ranking

The results of the evaluation, which will be presented below, are initially presented in overview as a table, followed by a more detailed ordering and explanation of each of the points and figures. The data collected for each of the countries show that within the comparison group of the 17 EU and OECD countries, Estonia is the country with the most advanced digital health system according to our survey methodology. Canada, Denmark, Israel and Spain follow at places two through five, while Germany again holds the next-to-last (16th) place (table 26).

Guide to reading: table 6 shows the Digital Health Index sorted by country ranking. The Digital Health Index can take values of between 0 and 100. A higher value represents a higher level of digital health development. The details of the calculation can be found in chapter 2.

After the top group containing the five countries of Estonia, Canada, Denmark, Israel and Spain (all over 70 points, from 71 to 82), a second group of four highly advanced countries trails closely behind, each with 66 to 69 points. Here we find England's NHS system, Sweden, Portugal and the Netherlands.

Separated by a rather larger gap comes a third group of four countries with 54 to 60 points, which includes Austria, Australia, Italy and Belgium.

In the final group, lagging considerably behind (28 to 41 points), are Switzerland, France, Germany and Poland.

TABLE 26: **Country ranking according to the Digital Health Index**

Rank		Digital Health Index	
1	Estonia	81.9	Group 1 > 70
2	Canada	74.7	
3	Denmark	72.5	
4	Israel	72.4	
5	Spain	71.4	
6	NHS England	70.0	Group 2 ≤ 70
7	Sweden	68.3	
8	Portugal	67.2	
9	Netherlands	66.1	
10	Austria	59.8	Group 3 < 60
11	Australia	57.3	
12	Italy	55.8	
13	Belgium	54.7	
14	Switzerland	40.6	Group 4 < 50
15	France	31.6	
16	Germany	30.0	
17	Poland	28.5	
	Average	59.0	
	Standard deviation	16.9	

Guide to reading: Table 26 shows the Digital Health Index sorted by country ranking. The Digital Health Index can take values of between 0 and 100. A higher value represents a higher level of digital health development. The details of the calculation can be found in chapter 2.
Source: Bertelsmann Stiftung

In general, the point differences between some of the surveyed countries are small. Considered systematically, these countries show a similarly high state of healthcare-system digitalization – often, however, in very different categories (sub-indices). The Digital Health Index does not provide any direct evidence as to whether countries receiving similar point totals in the ranking are similarly advanced in the same areas. Thus, in the following, the surveyed countries are addressed in alphabetical order according to their German denomination.

Germany

The Digital Health Index places Germany at 16th place in the overall ranking, with 29 points. Thus, the attempts to promote digital health issues at the political level, now ongoing for a number of years, have apparently resulted in no more than moderate success. With 42.1 points in the *policy activity* sub-index, Germany sits at 16th place, a member of the lowest-scoring group. In addition to the rigorous data-protection regulations typical for Germany, there is no overall strategic direction. Moreover, there is a lack of financial incentives for introducing and operating industry-produced, gematic-certified solutions on a nationwide scale (for details, see the country report in chapter 3.2). There is no centralized political coordination by an authority tasked with such responsibilities. Germany's level of *readiness* is the second-lowest in the entire ranking (29.2 points, at 16th place). No digital applications are yet in operation on the national level. The gematic organization has published a steady stream of new standards and interoperability rules that must be fulfilled in order to allow digital solutions to be connected to the telematics infrastructure. However, the telematics infrastructure is not mandatory to use. Care providers in Germany are under no compulsion to use gematik's work, and are thus free to develop their own solutions. With regard to *actual use of data,* Germany holds 15th place, with 15.4 points. Generally speaking, healthcare data are for the most part documented electronically, and insurance companies use physicians' billing data for health reporting.

Australia

Digital health efforts in Australia, and the associated decades-long development process, have in the past been paused, evaluated and reoriented after each new change in government. Despite investments totaling billions of euros, and the development of an overall digital architecture, Australia lands at only 11th place, with 57.3 points. On the *policy level,* Australia performs considerably worse (60.3 points, at 14th place) than other digital health pioneers. There is no overarching legal framework, and the degree of stakeholder involvement is comparatively low, although political commitment is quite high, and accompanying strategic documents and a coordinating digital health agency do exist. With regard to *readiness,* Australia performs better in comparison to the Digital Health Index, taking 9th place (64.4 points). On the one hand, Australia has an ePrescription service, health portals at the provincial level, an EHR system, and strong standardization efforts. On the other, weaknesses are evident with regard to the telemedicine infrastructure, mHealth and the implementation of standards that would ensure interoperability. In the *actual use of data* sub-index, Australia also performs somewhat better (47.2 points, at 10th place). ePrescriptions can be used nationally, and the outpatient-care sector is well integrated even among specialist physicians. However, the degree of connection to the inpatient care sector remains low. The lack of standards and interoperability prevents the full potential of the EHR system from being realized.

Belgium

At 13th place, with 54.7 points, Belgium falls into the lower tiers along with Austria, Australia and Italy. In the *policy* area, Belgium comes at 13th place (73.8 points), only a few points behind advanced countries such as Israel, England and its NHS system, and Sweden. It has a clear strategy with a highly developed financing system and strong institutions. However, data-protection issues and implementation plans are addressed less strongly. With regard to *readiness,* Belgium takes 12th place, with 53.7 points. National services such as the ePrescription system, a patient-summary system and a medication list are available, and successful standards have been implemented. However, Belgium lags strongly behind with regard to health portals, regulations giving patients access to their data, and interoperable EHRs. The use of ePrescriptions is moderate, but the connection to the outpatient-care sector is somewhat poor. The patient summary system is successful, and is used widely in Belgium (13th place in *actual use of data,* with 36.6 points). In general, Belgium has relatively few digital services; however, those that exist function well and are used.

Denmark

At 3rd place, with 72.5 points, Denmark is one of the leaders in the Digital Health Index, just behind Estonia and Canada. On the *policy level,* Denmark falls at 4th place with 80.8 points: The country has a comprehensive strategy and legislative framework, and several strong

NB: The sequence of country chapters is arranged according to country names in German.

institutions deal with various areas ranging from standardization to compliance with data-protection regulations to the financing and development of objectives for specific projects. In the *readiness* category, the Danes lag somewhat farther behind, falling at 8th place with 66 points. The EHR system is not yet fully realized, because the digital records for the outpatient and inpatient sectors are not yet interoperable, and data can only be exchanged via medication files if it is connected to the ePrescription server. Digital services in Denmark generally have a long history, and a high penetration rate. This results in a very high *actual degree of use* with regard to applications and data exchange; consequently, Denmark takes second place in this area with 70.6 points, close behind Estonia.

Estonia

Estonia leads the Digital Health Index with 82.4 points, well ahead of all other countries. Digitalization is a political process that began in the 1990s and has affected all areas of the public administration and state apparatus, thus including the healthcare system. This did not entail a public debate; rather, necessary steps were identified by the authorities responsible, and rigorously implemented. The legal framework has been fully aligned with the requirements of the digital health sector (88.6 points). The country's level of *readiness* is the highest observed among the countries examined (86.1 points). The national infrastructure enables an unparalleled integration of all digital healthcare services, along with associated access to all patient data. ePrescriptions, EHRs, patient summaries and health portals are fully established and used on an cross-sectoral basis, and the system's high degree of standardization allows for the automatic exchange of data. Consequently, the country also receives the highest *actual use of data* score, with 71.7 points.

France

While only a small distance ahead of neighboring Germany at 15th place, with 31.6 points, France is already several steps ahead in terms of development. Apart from the new digital health strategy and transfer of competences to a new institution, as well as funding programs, there is little activity at the political level. There is a comparative lack of well-defined objectives, stakeholder involvement is weak, and there is no comprehensive legal framework for the exchange of healthcare information (39.9 points for *policy activity*, at 17th place). However, a functional medication list, the successful definition of standards, and the development of a technical foundation for an EHR system push France several points ahead of Germany with regard to the *readiness* of digital applications (33.2 points, at 15th place). In France, at least a small amount of unstructured data is saved in the national EHR system; this, along with the medication-record system, provides for a significant improvement beyond Germany, Switzerland and Poland with regard to the *actual use of data* (14th place, with 21.7 points).

Israel

With 72.4 points, Israel sits at 4th place, only a small distance behind Denmark. The country's comparatively low ranking in the *policy activity* sub-index (7th place, with 78.5 points) primarily results from the state's longtime reluctance to engage in active participation, and the resulting lack of regulation in the area. Certainly, the four health maintenance organizations (HMOs) are financed by the state, but they are largely independent in their design of care structures and engage in direct competition with one another. Despite its lack of strong political leadership and a comparatively weak focus on data-protection issues, Israel has one of the world's most modern digital health systems. In the *readiness* sub-index, Israel falls at 5th place (69.5 points). From a technical standpoint, the HMOs all possess state-of-the-art systems, with ePrescriptions, telemedicine mechanisms, online access to the electronic records of general-practitioner physicians, and patient summaries are all well established. However, there is no central coordination by the state, and there is a lack both of interoperability between the HMOs and cross-border exchange of data. In the *actual use of data* sub-index, Israel lands at 3rd place with 69.4 points, in large part because the availability of information is crucially important within the HMOs, and the spread of digital services is strongly supported.

Italy

With 56.3 points, Italy occupies the 12th-place position, showing very mixed and regionally fragmented patterns of healthcare-sector digitalization. The regions act largely independently; consequently, the central state can do no more than initiate preparatory legislation in this area. Nevertheless, there is considerable *policy activity* (11th place, with 73.6 points): a national digitalization authority works with the regions, while the legislative projects that receive further development at the regional level are in fact well-adapted to digital health systems. For example, the law bringing an end to paper prescriptions, which was developed in cooperation with all the regions, is quite advanced. With regard to digital health *readiness,* Italy sits at 11th place (56.6 points). ePrescriptions are gradually becoming the dominant form of prescription, and EHRs are being used or at least developed in some regions. The central government is making an effort to unify standards and support the regions. With 37.3 points, Italy remains at 12th place in the area of *actual use of data.* The only uniformly used national-level service is the ePrescription system. However, with regard to functionality, it is limited to each individual region. Aside from the somewhat successful use of EHRs and health data for the purposes of monitoring the healthcare system, Italy performs more poorly on the other indicators.

Canada

At 2nd place in the global ranking with 74.7 points, Canada features a regionalized but centrally controlled digitized healthcare system. Canada Health Infoway, the central coordinating institution, is the mainstay point of digitalization; this entity manages financial resources, develops standards and implementation goals in close cooperation with stakeholders, and monitors project progress. Investment plans are closely aligned with strategic documents and the general direction of current healthcare-sector digitalization goals. The most important laws are implemented by the regions. In the *policy activity* sub-index, Canada lands at 2nd place, with 87.3 points. With regard to digital health *readiness,* a more differentiated picture emerges. Some regions are more strongly digitized than others. While the spread of healthcare portals, telemedicine services and mHealth functions are somewhat less pronounced, ePrescriptions are already issued in many regions. Thanks to strong cooperation on standards and terminology guidelines, regional EHR systems in the outpatient and inpatient sectors are integrated with one another, and can be processed by national authorities for the purposes of healthcare-system monitoring. Overall, the country holds 4th place in this area, with 71.4 points. Canada sits at 4th place in the actual *use of data* sub-index too, with 65.3 points. EHRs are already an integral component of care in some regions. The strong use of regional, structured coded data for the purposes of national monitoring is particularly striking in a regionally organized healthcare system.

NHS England

Receiving 70 points, England sits at 6th place. It holds the same rank (with 78.1 points) in the *policy activity* sub-index, with only a small gap separating it from the leading countries. Both the strategic and the institutional-legal frameworks are well developed, although stakeholder involvement and data-protection issues are addressed to only a lesser extent. England's NHS system performs better in the *readiness* sub-index (3rd place with 72.5 points). Here, robust activities with regard to standards and interoperability carry particular weight, along with the comprehensive panoply of digital services and the support provided for patient-empowerment programs. Only in the area of telemedicine are the two leading countries of Spain and Estonia considerably better positioned. The middling rank in the *actual use of data* sub-index (8th place, with 59.3 points) is bolstered by the strong use of ePrescriptions and patient summaries, as well as the use of such data for secondary purposes. At the same time, there is only a small amount of data exchange between individual care sectors, a circumstance attributable to systemic causes.

Netherlands

In the global Digital Health Index, Netherlands sits at 9th place, with a total of 66.1 points. While a high degree of engagement, stakeholder involvement and legal regulation can be identified at the *policy* level (3rd place, with 85.2 points), national and regional applications and services display a comparatively low degree of *readiness* (the Netherlands sits at 13th in this sub-index, with 51.8 points). Since the political turning point in 2011, and due to the enormous diversity in private and public applications and actors, there has been a lack of regulatory consistency and interoperability, and especially of clarity. Recently, there have been efforts to unify various systems in the context of newer projects (e.g., MedMij). An ePrescription system is currently being tested, and telemedicine applications are not yet a nationwide reality in the Netherlands. At best, national healthcare information infrastructure allows a minimum level of data exchange between care providers via various electronic files. Thus, Germany's neighbor sits at 6th place in the third sub-index, with 59.3 points.

Austria

Austria is located at 10th place in the Digital Health Index, with 60.3 points. The stronger placing in the *policy activity* sub-index (6th place, with 78.8 points) results from a years-long process that has resulted in the development of the country's Electronic Health Record (ELGA) system. The crucial political conditions for the still-developing digital healthcare sector have been created through the incorporation of clinical actors, the future system users, and the establishment of a legal framework with the ELGA as the coordinating entity. At the time of writing, the ELGA was still in a process of national rollout, with the inpatient care sector being the first to be connected to the system. The necessary standards, documentation types and data-exchange profiles were already defined in advance. The low level of *readiness* (10th place, with 60.7 points) is ultimately due to the modular construction of the ELGA; that is, individual functions are being successively added to the system, and to date, only the electronic medical-results function has been implemented. The score for *actual data use* is accordingly low at 39.9 points, giving the country 11th place in this area.

Poland

Poland sits at the bottom of the digital health rankings, falling at 17th place with 28.5 points. In the *policy* sub-index, it outstrips Germany and France (15th place, with 48 points). Policymakers and care providers have been able to agree on a fundamental strategy, thus giving digital health developments a more concrete timetable. The development of standards has also progressed further in Poland than in Germany. However, significant financial gaps remain, along with a poor IT infrastructure, and the processes of adapting various laws to the sector's requirements has not yet been fully completed. In the areas of *readiness* and *actual data use,* Poland also holds the bottommost index rank (with a respective 25.9 and 11.8 points). Only the access-management and technical standards exist; otherwise, no applications enabling data exchange have been implemented.

Portugal

At 8th place with 62.7 points, Portugal falls into the middle ranks. Only slightly behind Italy, Belgium and Spain, it ranks at 12th place (72 points) in the *policy activity* sub-index. Digital health goals are not backed by legally binding milestones, and are supported by a rather thin set of legislative instruments. However, Portugal is rated comparatively highly with regard to the *readiness* of its digital applications, sitting at 6th place in the second sub-index with 68.6 points. The country's ambitious healthcare-data platform combines EHRs, patient summaries and other services in one portal, and is already operational in part. In many areas, interoperability is better developed than in other countries. ePrescriptions have entirely replaced paper-based prescriptions, and patient summaries too are often used by a variety of care providers. Portugal sits at 7th place in the *actual use of data* sub-index (60.9 points).

Sweden

With 68.8 points, Sweden sits at 7th place in the Digital Health Index and lies closely behind Denmark at 5th place in the *policy activity* sub-index (79.9 points). The country is well positioned at the strategic level, and with a few exceptions, its legal and institutional frameworks are well developed. With regard to digital health *readiness,* Sweden is the 7th best (67.4 points) among the countries surveyed. Due to cultural differences with regard to data and privacy protections, Sweden was not able to score highly in this area; moreover, the active push for interoperability through uniform standards is a recent project, though promising. To date, there has also been relatively little activity in the area of telemedicine. In comparison to its composite index position, Sweden drops two ranks in the *actual use of data* sub-index (9th place, with 57.5 points). This is in part due to particularities in the Swedish system (e.g., regional EHRs vs. national patient summaries, the major significance of quality registries[344]), but also to the continuing lack of interoperability between care providers. However, the high degree of data availability and the integration of disease-specific databases in EHRs is nearly unique from a comparative perspective.

344 For more information, see the Sweden country report, chapter 6.16.

Switzerland

Thanks to active digital health efforts, Switzerland falls at 14th place with 40.6 points, significantly ahead of France and Belgium. Generally speaking, the federally organized Switzerland has not been able to initiate applicable national-level laws, as it is required to respect the autonomy of the individual cantons. In this regard, the successful cooperation between various institutions and stakeholders, as well as the digital health strategy's role as a key roadmap, are worthy of particular notice. Only the financial aspects with regard to implementation and the operation of the electronic patient files (EPDs) remain to be fully clarified. For this reason, Switzerland is a country of transformation especially because the necessary political provisions, technical specifications and EPD requirements are defined, but the implementation of the system is only just beginning to take place. In this regard, Switzerland is a significant step beyond Germany, France and Poland, but has not yet caught up with other digitized countries. The coming years will show how well the EPD system functions. Currently, the country sits at 14th place with regard to *readiness*, with 44 points. In the actual use of data sub-index, Switzerland is correspondingly at 16th place, with 14 points.

Spain

With 71.4 points, sitting at 5th place, Spain is one of the countries with quite advanced digital healthcare systems. Despite a rather average *policy activity* score (73.8 points, sitting at 9th place) due to a lack of central coordination and the quite varied regional implementation of financing measures and legal adaptations to digital heath needs, the country's *readiness* score is the second-highest (76.9 points) among the nations examined in this study. Although the national standardization body has no enforcement power, basic standards have been established in the Spanish regions, and the regional EHR systems are able to export data to a national patient-summary system. In contrast to the comprehensive regional ePrescription systems, telemedicine has been implemented in the form of services between physicians, with less focus on direct patient services. In the *actual use of data* sub-index, Spain numbers among the leading countries, at 5th place with 63.3 points. ePrescriptions are used and healthcare data is documented electronically on a regional basis, but data exchange takes place mostly in the form of patient-release or transfer documents swapped between general practitioners in medical practice and hospitals. Data is used to a greater extent for research and monitoring purposes.

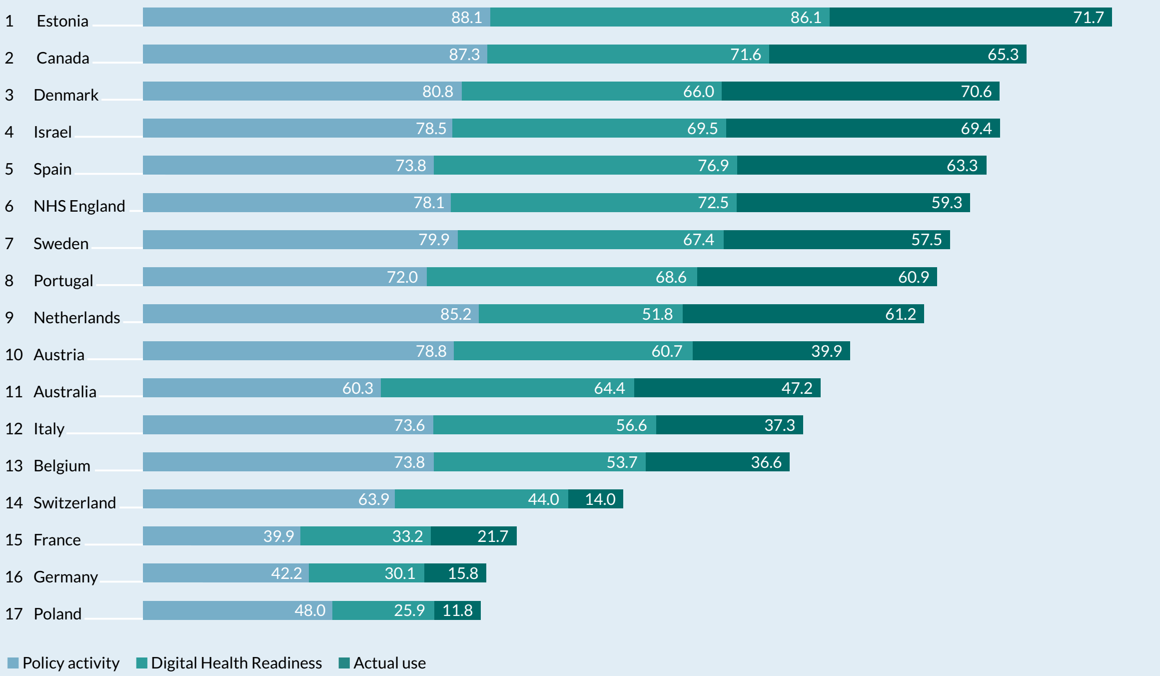
Figure 42 shows how the Digital Health Index is constructed from the individual sub-indices in the countries examined for this study. In this rendering, up to 100 points are possible for each sub-index, meaning that 300 is the maximum score achievable for the Digital Heath Index. The length of the bar corresponds to the Digital Health Index score.

The ranking results are presented in figure 44 on a geographical overview map. Here, the counties are colored according to their point totals in the Digital Health Index.

On the map, it can be seen that the Central European countries have the lowest overall point totals in the Digital Health Index. Higher point totals can be found particularly in Northern Europe, and altogether outside of Europe.

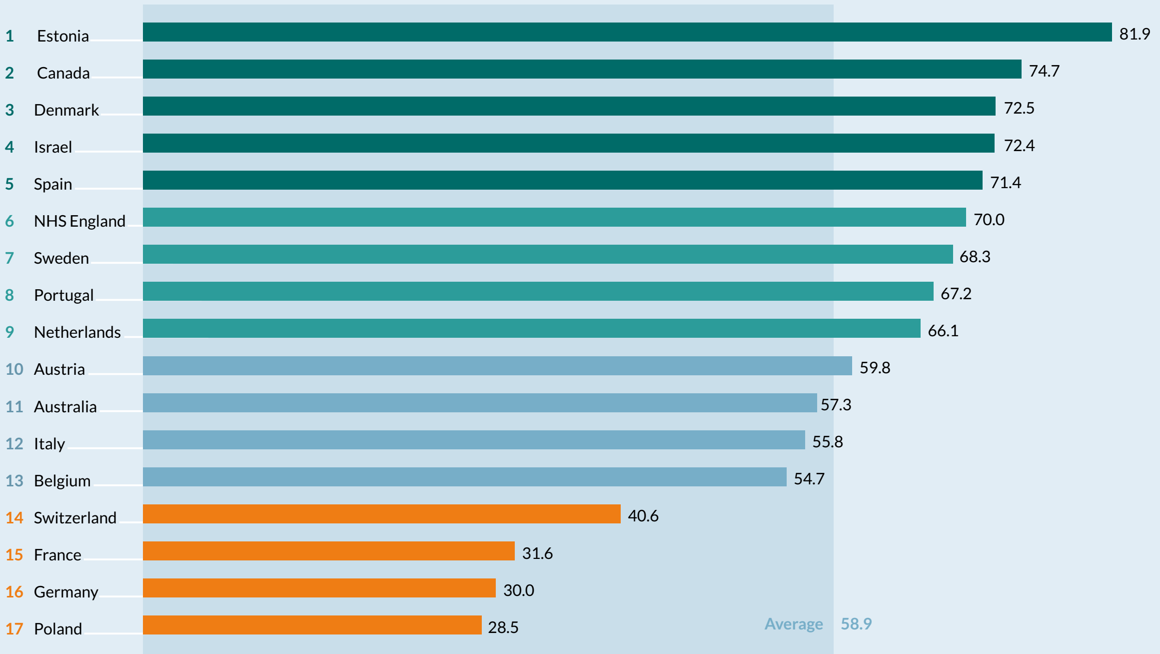
FIGURE 42: **Digital Health Index as the sum of the sub-indices, per country**

Guide to reading: The sub-indices are presented in bar format. In this regard, they are simply added one to the other, and the bars are accordingly stacked one on top of the other. The composite index value is obtained by dividing the total height of the bars by three.



Source: Bertelsmann Stiftung

FIGURE 43: **#SmartHealthSystems: Digital Health Index, per group**

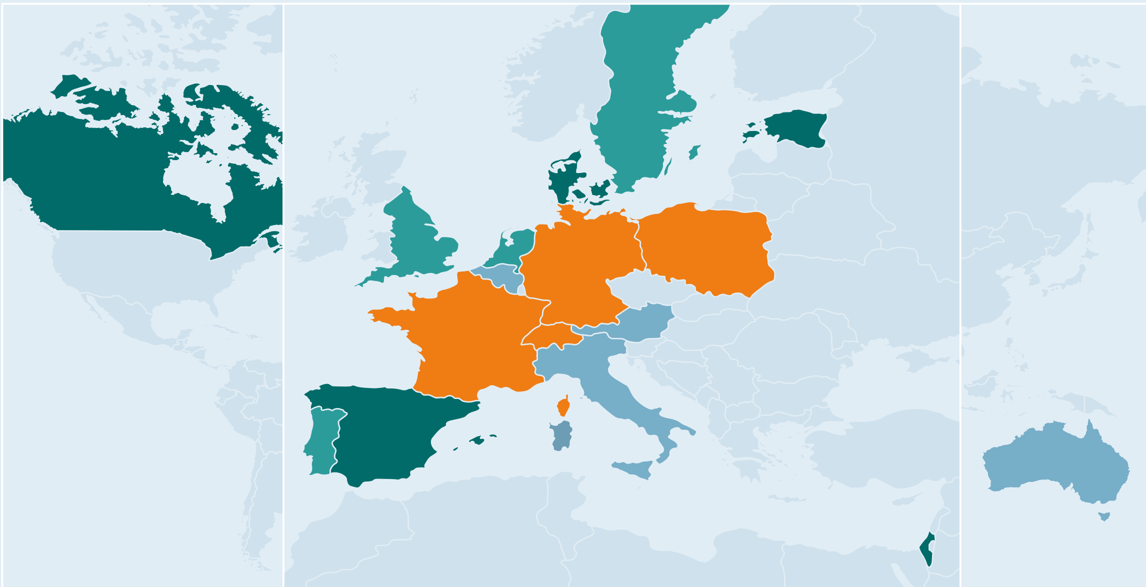


14 EU Member States and 3 OECD countries, index = (Policy activity + Digital Health Readiness + Actual use) divided by 3

Source: Bertelsmann Stiftung

FIGURE 44: **Map: Digital Health Index**

The five countries in the Digital Health Index's leading group, including Estonia, Canada, Denmark, Israel and Spain, are only a small amount ahead of the next-best countries in the second group. England's NHS system, Sweden, Portugal and the Netherlands all have broadly digitized healthcare systems. In the bottom half of the rankings, Austria, with its comparatively recent digitalization efforts, is located at the top of the third group. The composite index's final group is led by Switzerland, which sits considerably ahead of France, Germany and Poland.



Digital Health Index: 0 – 50 50 – 60 60 – 70 70 – 100 other countries
Source: Bertelsmann Stiftung

Following the above observations regarding the Digital Health Index, chapter 4.2 will address the more nuanced results of the individual sub-indices below, each presented in a similar format as a composite index with a ranked table and geographical overview map.

4.2 Sub-indices

How are these country scores produced by the underlying sub-indices? Can a country's relative strengths and weaknesses be discerned by examining the individual dimensions, thus enabling identification of the intervention goals demanding highest priority? To answer these questions, the following section will analyze the index on the basis of its component parts, focusing initially on the three sub-indices. The following tables indicate how the countries compare in the three sub-index rankings, and whether each county has "improved" or "deteriorated" in a given sub-index as compared to its score in the composite index. Changes are shown using either a downward arrow (a decline in rank) or an upward arrow (a gain in rank). An unchanged ranking is indicated with the use of a sideways-facing arrow. The ranking position shown in brackets also indicates the country's place in the composite index.

Overview: As the top overall placer, Estonia is consistent in its performance, taking the top ranking in all three sub-indices. Canada, the second-place overall finisher, stands out with strong policy activity (2nd place), and similarly good rankings with regard to data use (4th place) and readiness (4th place). Denmark, at 3rd place overall, sits at 2nd place with regard to actual data use, and at 4th and 8th place in the two other sub-indices.

At 4th place, Israel also shows a relatively consistent placing across the three sub-indices, at 7th, 4th and 3rd place. Spain, at 5th place, scores particularly well in the area of readiness.

In the overall view, a high level of correlation between the indicators is evident; the correlation between rank levels ranges between 0.66 and 0.82, while the correlation between point values ranges between 0.82 and 0.88. Accordingly, large variations in rank for individual counties are an exception. Germany, for example, ranges only between 15th and 16th place.

Switzerland is the country which, in comparative terms, shows the least consistent performance across the sub-indices (measured in terms of the variance between sub-index values), followed to a lesser degree by Austria, Poland, Italy and the Netherlands. The remainder of the countries show relatively consistent performances across each of the survey dimensions.

TABLE 27: **Policy activity Sub-index rankings and comparisons to the composite Digital Health Index**

Rank Policy	(Composite rank)	Change	Country	Sub-index
1	(1)	→	Estonia	88.1
2	(2)	→	Canada	87.3
3	(9)	↑	Netherlands	85.2
4	(3)	↓	Denmark	80.8
5	(7)	↑	Sweden	79.9
6	(10)	↑	Austria	78.8
7	(4)	↓	Israel	78.5
8	(6)	↓	NHS England	78.1
9	(5)	↓	Spain	73.8
10	(13)	↑	Belgium	73.8
11	(12)	↑	Italy	73.6
12	(8)	↓	Portugal	72.0
13	(14)	↑	Switzerland	63.9
14	(11)	↓	Australia	60.3
15	(17)	↑	Poland	48.0
16	(16)	→	Germany	44.2
17	(15)	↓	France	39.9
			Average: **Standard deviation:**	**71.0** **14.8**

Guide to reading: The Digital Health Index can take values of between 0 and 100. A higher value represents a higher level of development in the area of digital health. The Digital Health Index is composed of three sub-indices, which in turn are based on individual indicators. The details of the calculation can be found in the text. The place ranking in brackets, in the first column, refers to the composite index in table 26. A change in the sub-index ranking relative to the composite index is indicated either with a downward-pointing arrow (a decline in rank) or an upward-pointing arrow (a gain in rank). An unchanged ranking is indicated with the use of a sideways-facing arrow.
Source: Bertelsmann Stiftung

4.2.1 Policy activity

Estonia is the top-ranking country in the policy activity sub-index, followed by Canada and the Netherlands.

Overall, this sub-index shows the highest point totals, which reflects the assumed policy -> readiness -> use chain of effects. Germany is located at the second-to-last place, lacking even half as many points as the top three nations.

Within the policy activity sub-index, the P1 "Digital health is an integral element of the general healthcare strategy / healthcare policy" indicator achieved the highest average value (91.8). This is a sign that most of the countries surveyed are in fact pursuing a digital health strategy as a part of their healthcare policy. The lowest value was received by

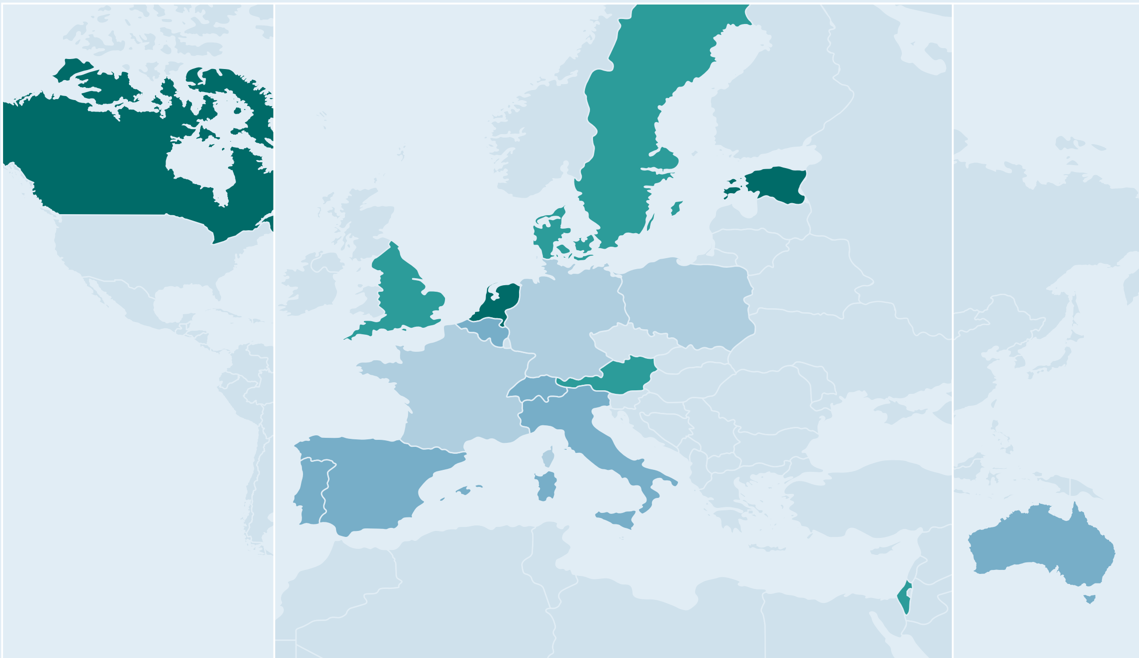
TABLE 28: **Policy activity and strategy: Indicators according to average point total achieved**

Policy Activity and Strategy: Indicators		Average point value	Maximum	Achieved by	Minimum	Achieved by
P1	Digital health is an integral part of general health policy	**91.8**	100.0	AU, BE, FR, ISR, IT, CA, NL, GB, AT, SE, CH	60.0	DE
P8	Digital health service refunding and financing is in place on the national / regional level	**77.9**	100.0	EE, ISR, IT, CA, NL	50.0	DE, FR, ES
P2	Political will to support data transfer and data exchange is advanced	**77.2**	100.0	AU, BE, NL, GB, AT, SE, ES	25.0	EE, FR
P11	National or regional legislative frameworks allow for com-pre-hensive and privacy-protective secondary use of health data	**76.2**	100.0	DK, EE, IT, CA, NL, GB, AT	31.3	AU
P3	An effective strategy to digitalise the healthcare system is in place	**75.0**	100.0	EE, ISR, GB, ES	28.6	DE
P7	A national digital health entity has been established for oversight of digital health implementation	**72.5**	100.0	AU, EE, ISR	0.0	DE
P10	Legal frameworks in place to protect sharing of patient data	**68.5**	100.0	EE, NL, SE	28.6	GB, PL
P6	National and regional-level financ-ing of implementation and operation of digital health applications and services is sustainable	**63.7**	100.0	DK, CA, GB, PT, SE	0.0	DE, FR
P9	Digital health policies and regulation provide financial incentives for providers to take-up digital health apps and services	**62.8**	100.0	BE, EE, CA, NL	25.0	AU, PL, SE, CH
P4	Clear guidelines and timelines have been established to plan and implement digital health solutions	**62.4**	100.0	DK, EE,	16.7	DE, FR
P5	Governmental institutions and key healthcare stakeholders are co-operating in digital health planning and implementation	**62.4**	100.0	EE, CA, SE	20.0	AU, FR, PL
P12	Capacity-building measures are in place for digital skills and human resource development	**59.7**	100.0	ISR, ES	30.0	AU, BE, FR

Source: Bertelsmann Stiftung

FIGURE 45: **Map: Policy activity**

The Netherlands has risen by five places into the top group for the policy activity sub-index. Austria, too, was able to make up four places, and is located in the second group. By contrast, Israel, Spain and Portugal respectively have fallen by three, four and five places in comparison to the composite index.



Policy activity: 0 – 60 60 – 78 78 – 81 81 – 100 other countries

Source: Bertelsmann Stiftung

"Measures for the promotion of digital literacy." For the "Measures for the promotion of digital literacy and personal development are in place" indicator, only Israel and Spain received the maximum number of points. For half of the 12 indicators, Germany received only the empirically determined minimum for the indicator.

Table 29 reorders the indicators according to the average point total achieved, and additionally indicates which countries performed best (maximum score), and which performed worst (minimum score). This reordering shows which indicators have been given the highest priority in the individual countries, and which indicators may not yet have been the subject of focus in some countries (minimum equal to 0).

Below, the results of the ranking in the policy activity sub-index are again compiled in an overview map. The map is constructed the same way as for the Digital Health Index.

As with the overall Digital Health Index, it is clear that for the policy activity sub-index, particularly high values can be found particularly in Northern Europe and in the non-European countries.

The Netherlands has risen by five places into the top group of the policy activity sub-index. Austria was able to make up four places, and is located in the second group. By contrast, Israel, Spain and Portugal have respectively fallen by three, four and five places in comparison to the composite index.

TABLE 29: **Digital health readiness rankings and comparisons to the overall Digital Health Index**

Rank Digital health readiness	(Composite rank)	Change	Country	Sub-index
1	(1)	→	Estonia	86.1
2	(5)	↑	Spain	76.9
3	(6)	↑	NHS England	72.5
4	(2)	↓	Canada	71.6
5	(4)	↓	Israel	69.5
6	(8)	↑	Portugal	68.6
7	(7)	→	Sweden	67.4
8	(3)	↓	Denmark	66.0
9	(11)	↑	Australia	64.4
10	(10)	→	Austria	60.7
11	(12)	↑	Italy	56.6
12	(13)	↑	Belgium	53.7
13	(9)	↓	Netherlands	51.8
14	(14)	→	Switzerland	44.0
15	(15)	→	France	33.2
16	(16)	→	Germany	30.1
17	(17)	→	Poland	25.9
			Average: **Standard deviation:**	**58.8** **17.1**

Source: Bertelsmann Stiftung

The results of the digital health readiness and actual data use sub-indices are addressed below and will be presented in the same manner.

4.2.2 Digital health readiness

Estonia also ranks firs in the digital health readiness sub-index, followed by Spain and England's NHS system. Overall, this sub-index shows somewhat lower point totals. Germany is once again situated at the penultimate place.

In the following, the indicators are again ordered and interpreted on the basis of the average point total received. We will first offer a detailed consideration of notable aspects in this ranking, followed by an overall overview of the indicators. Once again, this shows which indicators in the individual countries have received the highest priority, and which indicators may not have been the subject of focus (minimum equals 0).

The greatest amount of progress can be seen in the area of privacy protection. Even here, Germany receives the maximum number of points. In addition, regulations regarding

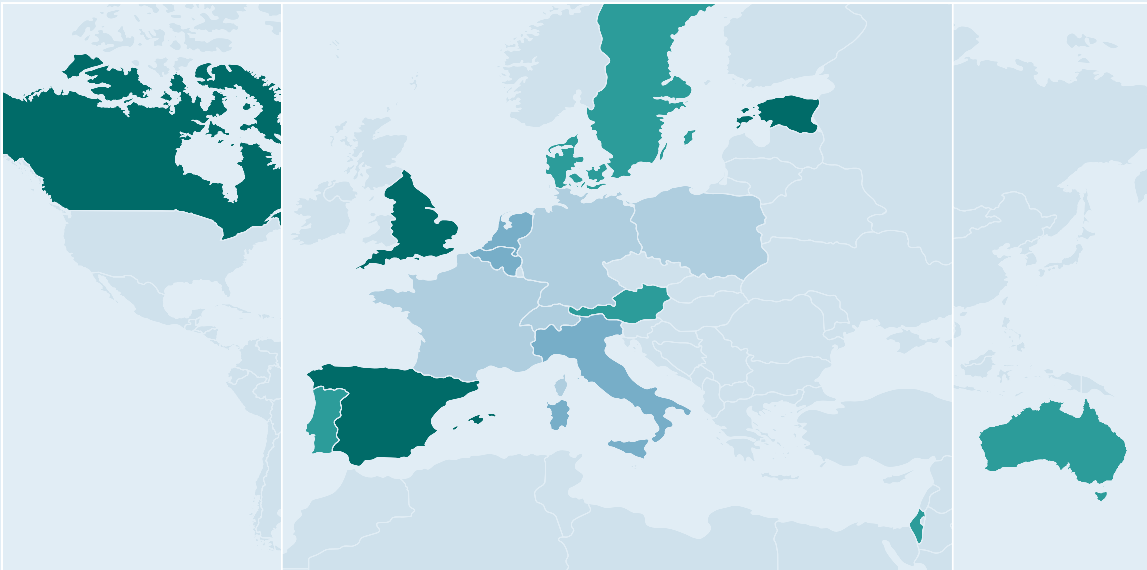
TABLE 30: **Technical implementation and readiness for data integration and use: Indicators according to average point total achieved**

Technical Implementation and Readiness for networking and data use: Indicators		Average point value	Maxi-mum	Achieved by	Mini-mum	Achieved by
T2	Sufficient security actions are in place to secure patient privacy	**88.2**	100.0	AU, BE, DK, DE, EE, ISR, IT, CA, NL, AT, SE,ES	40.0	PL
T1	There is clear regulation on EHR access rules for the identification and authentication of health professionals and patients	**82.5**	100.0	BE, DK, ISR, SE	33.3	DE
T10	A governmental entity is responsible for defining standards for clinical terminology and technical interoperability for all stakeholders and applications	**80.6**	100.0	AU, EE, CA, GB, PL, CH, ES	20.0	NL
T12	Linking of national health datasets or EHRs to facilitate evaluation, health monitoring and process improvement	**62.1**	100.0	DK, EE, ISR, GB, ES	10.0	DE
T5	ePrescription services are operational	**59.6**	100.0	AU, EE, ISR, IT, CA, PT, SE, ES	0.0	DE, NL, PL, CH
T4	Patient summary and electronic health record (EHR) systems are implemented	**59.2**	88.3	ES	10.0	PL
T3	ICT standardisation and health informatics efforts are institutionalised through a national entity	**55.4**	100.0	BE, DK, EE, ES	0.0	FR, CH
T8	Patient control of content and access to the EHR	**55.1**	100.0	AU	0.0	PL
T11	Interoperability in EHR systems is facilitated through a standardised language and coding for all health service providers and other stakeholders in the country	**51.7**	100.0	EE, GB	5.0	DE, IT
T6	Telehealth and telemedicine can be routinely used	**47.5**	95.0	NL	15.0	BE, GB, AT
T7	Patient and health portals are ready to actively contribute to patient empowerment and patient-centred care	**47.4**	94.0	ISR	12.0	PL, CH
T13	Patient data can be transferred securely and automatically to transnational data networks (e.g. the EU Connected Europe Facility [CEF])	**46.3**	100.0	EE, PT	0.0	FR, ISR, NL, PL
T9	mHealth and mobile applications contribute to routine healthcare delivery	**27.5**	50.0	SE	0.0	PL, CH

Source: Bertelsmann Stiftung

FIGURE 46: **Map: Digital health readiness**

In general, the observed level of readiness is lower than the level of policy activity. Spain, Canada, Israel, Estonia and England's NHS system together constitute the top group, followed closely by Portugal, Sweden, Denmark, Australia and Austria. Considerably farther back are Belgium, Italy and the Netherlands. The lowest places are held by Switzerland, France, Germany and Poland.



Digital Health Readiness: 0 – 45 45 – 60 60 – 70 70 – 100 other countries
Source: Bertelsmann Stiftung

identification and authentication, as well as for the structural establishment of standards and interoperability, it appears to be well advanced in most of the countries surveyed (however, neither is true for Germany, which falls into the lowest group for both indicators).

There is a broad range of maturity with regard to all other indicators, with generally mid-range point totals. There are many examples of good implementation practices, for example regarding the use of healthcare datasets or ePrescription systems, or the institutionalization of ICT standardization efforts.

In other areas, such as electronic health records (EHRs) and patient summaries, patient oversight of and access to electronic records, and the routine use of telemedicine mechanisms, there are fewer examples of best practices for implementation.

Apps, mHealth and mobile applications have not reached the point of maturity in any of the countries surveyed.

Below, the results of the ranking in the digital health readiness sub-index are again summarized in the form of an overview map. The map is constructed in the same manner seen in the preceding chapters.

As with the previous versions of the overview map, it can be seen here that the strongest countries are at Europe's margins, or altogether outside Europe.

In general, the observed level of readiness is lower than the level of policy activity. Spain, Canada, Israel, Estonia and England's NHS system together constitute the top group, followed closely by Portugal, Sweden, Denmark, Australia and Austria. Considerably farther back are Belgium, Italy and the Netherlands. The lowest places are held by Switzerland, France, Germany and Poland. Observations regarding results in the area of actual data use, the last of the three sub-indices, are addressed below, using the same format.

4.2.3 Actual use of data

In the following, the indicators are again ordered and interpreted on the basis of the average point total received. The aspects in this reordering worthy of particular notice are presented first, followed by the overall overview of the indicators. The latter component once again provides information on which indicators in the individual countries have been given the highest priority, and which may not yet have been the subject of focus (minimum equals 0).

The indicator with the highest average point total is “Use of patient data for monitoring the healthcare sector.” Following at some distance are “Use of digital health applications

TABLE 31: **Actual use of data sub-index rankings and comparisons relative to Digital Health Index**

Rank Actual use	(Composite rank)	Change	Country	Sub-index
1	(1)	→	Estonia	71.7
2	(3)	↑	Denmark	70.6
3	(4)	↑	Israel	69.4
4	(2)	↓	Canada	65.3
5	(5)	→	Spain	63.3
6	(9)	↑	Netherlands	61.2
7	(8)	↑	Portugal	60.9
8	(6)	↓	NHS England	59.3
9	(7)	↓	Sweden	57.5
10	(11)	↑	Australia	47.2
11	(10)	↓	Austria	39.9
12	(12)	→	Italy	37.3
13	(13)	→	Belgium	36.6
14	(15)	↑	France	21.7
15	(16)	↑	Germany	15.8
16	(14)	↓	Switzerland	14.0
17	(17)	→	Poland	11.8
			Average: **Standard deviation:**	**47.3** **21.1**

Reading instructions: The Digital Health Index can take values between 0 and 100, with a higher value representing a higher level of development in the field of digital health. The Digital Health Index consists of three sub-indices, which in turn consist of individual indicators. The details of the calculation can be found in the text. The ranking in brackets in the first column refers to the composite index in Table 26. A change in the sub-index relative to the composite index is indicated by either a downward arrow (places lost) or an upward arrow (places won). A constant ranking is indicated by an arrow pointing sideways.
Source: Bertelsmann Stiftung

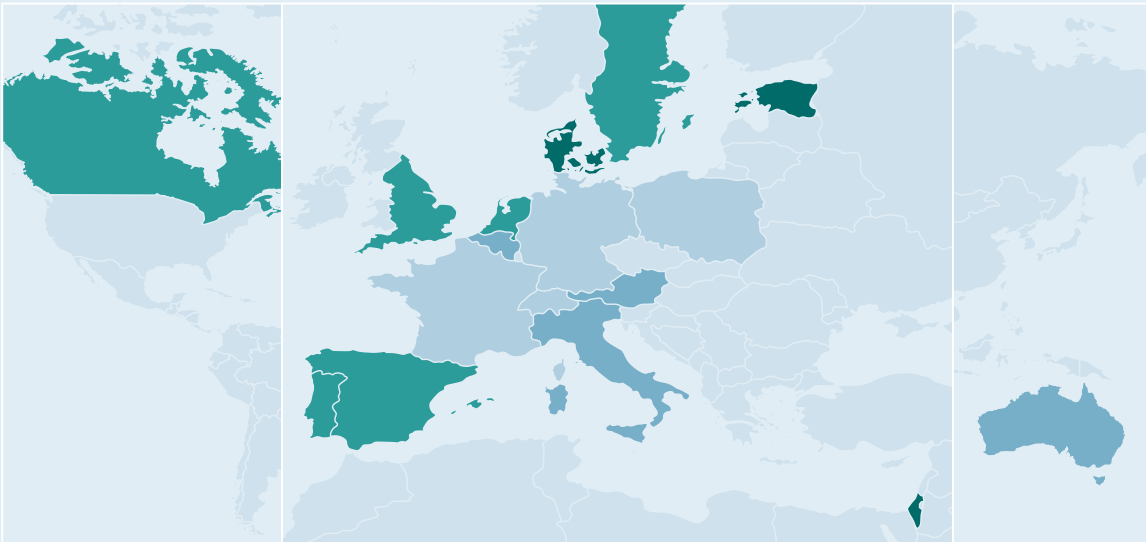
TABLE 32: **Actual use of data: Indicators according to average point total achieved**

Actual use of data: Indicators		Average point value	Maximum	Achieved by	Minimum	Achieved by
A6	For monitoring and improvement of health-care systems health data is used regularly	**80.7**	100.0	AU, CA, NL, GB, SE, ES	30.0	PL
A1	Digital health applications are a dominant solution for direct patient care	**65.1**	100.0	EE	20.0	PL, CH
A2	Electronic prescribing, transmission and dispensing of medicines is the dominant form of prescribing	**62.9**	100.0	AU, DK, EE, ISR, IT, PT, SE	10.0	DE, FR, AT, PL, CH
A5	Data sharing with third parties (e.g. analysts or researchers) is common and intended to generally improve healthcare system performances	**41.9**	75.0	DK, EE, ISR, CA, NL, GB, AT	0.0	BE, DE, IT, CH
A4	The use of primary and secondary data is used to enhance medical care and consulta-tion by GPs and in hospitals	**40.6**	83.3	BE, DK, EE	10.0	AU, DE, PL, CH
A3	Level of EHR uptake is high	**37.5**	68.3	PT	0.0	BE
A9	Patient portals offering access to personal healthcare information are highly frequented	**37.4**	77.5	DK, ISR, NL	10.0	DE, PL, CH
A8	The quality of data and clinical content of electronic records being shared among providers is high	**32.0**	100.0	ISR, GB	3.3	AU, BE, DK, DE, FR, IT, NL, PL, CH
A7	Automatic extraction of health data from EHR systems to national databases is pervasive	**27.3**	100.0	DK	0.0	ISR

Source: Bertelsmann Stiftung

FIGURE 47: **Map: Actual use of data map**

Healthcare data is exchanged most actively in Estonia, Denmark and Israel. Canada, Spain, the Netherlands, Portugal, England's NHS system and Sweden trail closely behind the leaders. Sitting some distance farther back is a third group containing Australia, Austria, Italy and Belgium. However, very little data exchange takes place in France, Germany, Switzerland or Poland.



Actual use: 0 – 22 22 – 50 50 – 69 69 – 100 other countries

Source: Bertelsmann Stiftung

for direct patient care" and "ePrescriptions." After an appreciable gap, "Exchange of data with third parties," "Exchange of data between healthcare professionals," "Electronic health records" and "Public healthcare-information portals" follow.

Very low average values were achieved for the "Structured and coded EHR contents" and "Retrieval of patient data from EHR systems" indicators.

The results of the rankings in the actual use of data sub-index are again presented in a geographical overview map below. The map is constructed in the same manner used in the preceding chapters.

As with the previous examples of the overview map, the strongest countries, or those countries with the highest point totals, are at Europe's margins or altogether outside Europe.

Healthcare data is exchanged most actively in Estonia, Denmark and Israel. Canada, Spain, the Netherlands, Portugal, England's NHS system and Sweden trail closely behind the leaders. Sitting some distance farther back is a third group containing Australia, Austria, Italy and Belgium. However, very little data exchange takes place in France, Germany, Switzerland or Poland.

Following this presentation and consideration of each of the indices, chapter 4.3 contains a more detailed analysis of the significance and mode of operation of the individual indices and selected individual indicators.

4.3 The magnitude of political influence on digital readiness and the actual use of data in the digital health sector

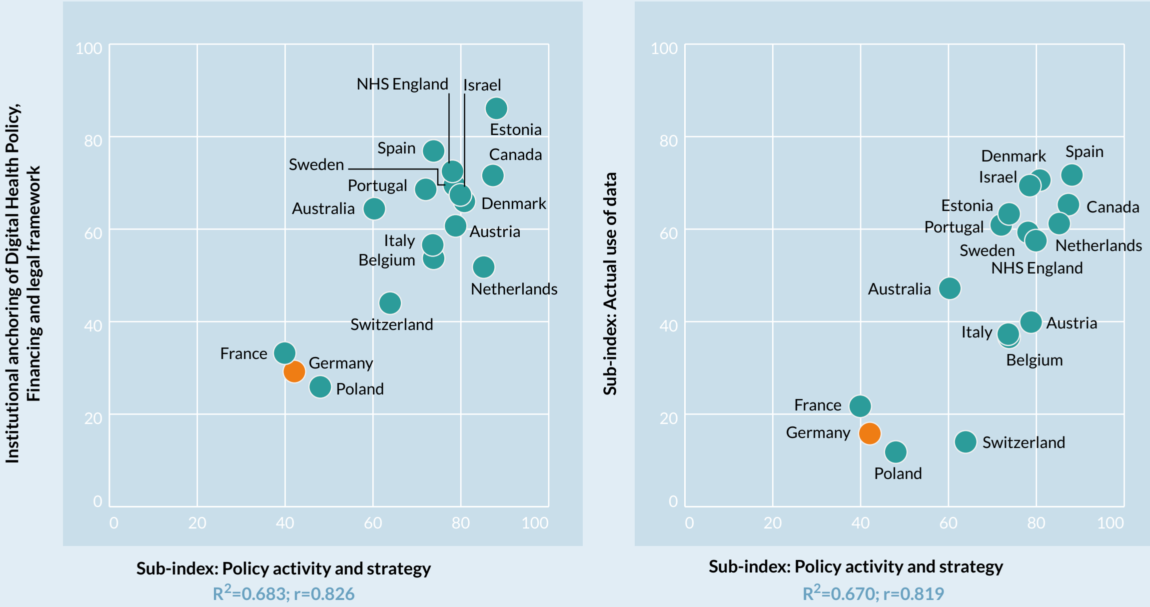
The *actual use of data* sub-index can be seen as a proxy for the actual state of healthcare system digitalization. The actual use of healthcare data is in this sense a (provisional) endpoint for the maturing of a digital health system, while political support and investments in the necessary infrastructure can be seen as antecedent factors. Accordingly, an empirical correlation between the three *policy activity, readiness* and *actual use of data* sub-indices can be expected, as the successful use of data presumably follows technical implementation, which in turn follows political strategy and activity. Figure 48 and 49 plot the *readiness* and *actual use of data* sub-indices against the *policy activity* sub-index. The juxtaposition of the indices is used to graphically depict correlations, trends and effects, for example with regard to how policy relates to the actual use of the data collected.

In addition to an analysis of the sub-indices, it also is interesting to highlight the influence of certain variables in a graphic manner – for example, the influence of the "P2: Political support for data transfer and exchange" variable on the actual use of healthcare data. In each of the following graphs, the relative point total for each indicator or subindicator is specified on a scale ranging between 0 and 100. The individual countries are indicated with blue diamonds. Germany, by contrast, is represented with a star.

If the *policy activity* sub-index is broken down into individual indicators, and these are plotted against actual data use, the strength of the correlation decreases (see figures 49 and 50). No indicator taken alone (e.g., "Political support," "Legal oversight of the digital health

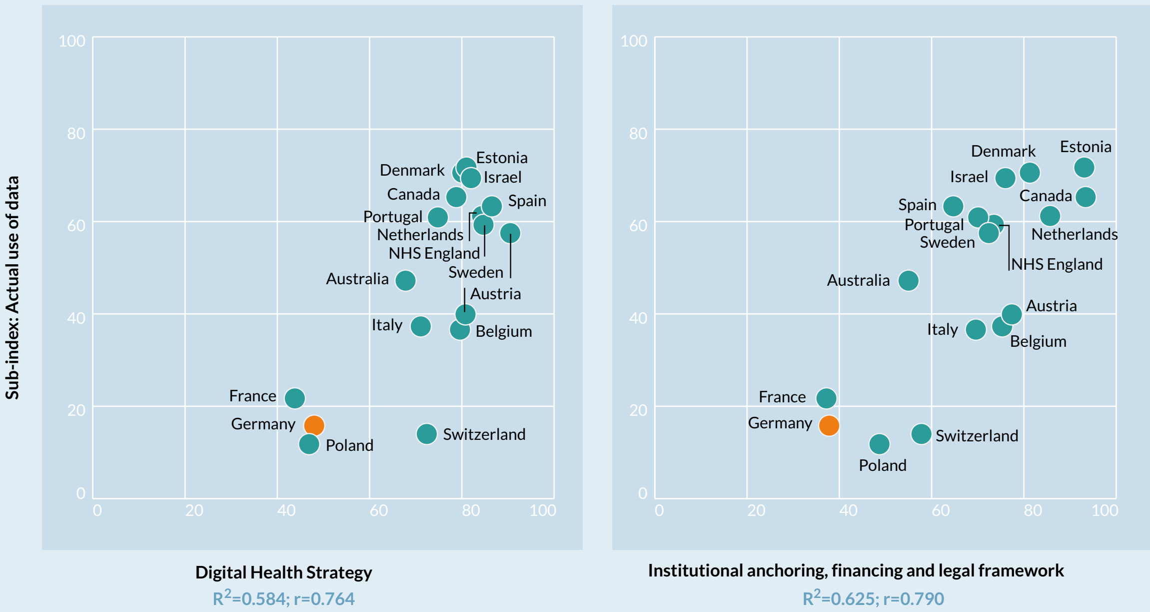
FIGURE 48: **Comparison of the policy activity sub-index with the actual data use and readiness sub-indices**

The policy activity and actual data use sub-indices, as well as the policy activity and technical implementation / readiness sub-indices, are plotted in two-dimensional space. Values further toward the top and further toward the right respectively represent better performances with relation to actual data use / readiness and with respect to policy activity.



Source: Bertelsmann Stiftung

FIGURE 49: **Juxtaposition of the "digital health strategy" and "institutional anchoring" policy components with the actual use of data sub-index**



Source: Bertelsmann Stiftung

sector" or "Financial incentives for digital health programs") can explain the actual data use. The importance of the sub-indices must therefore be emphasized. At the same time, this means that the overall *policy activity* package, which encompasses strategy, political support, financing, the establishment of standards, the recognition of an authority to coordinate digital health efforts, and legal oversight, is correlated with *actual data use* only in its entirety.

4.3.1 Influence of policy-related variables

There is a clear relationship ($r > 0.8$) between political activity and both technical implementation and actual use of data, as strikingly illustrated in the figures 50 and 51.

In both cases, Germany is located in the bottom-left corner of the continuum, with considerable room for improvement. Even if the sub-indices are not calibrated in the sense that a particular score on one index is of similar significance to the same score on another index (which would be simply impossible), there is nonetheless a clear tendency for high average technical-implementation values to correspond with somewhat lower values in the area of data use. Here, a certain natural consequence of the digital heath maturation process is evident.

The *policy activity* sub-index can be further divided into a *"digital health strategy"* component (general healthcare policy, political support, strategy for healthcare-system digitalization, timetables for this digitalization and its implementation, cooperation between the government and key stakeholders), and an *"institutional anchoring"* component (sustainable financing, digital health legal entities, public financing for digital healthcare services, financial incentives, legal frameworks, data-protection and privacy-protection provisions, competence-development programs).

Here, it is evident that the institutional anchoring is somewhat more strongly correlated with the actual use of data; however, the strategy dimension is also highly correlated.

However, if the policy indicators are broken down further, now going to the level of individual indicators, it becomes clear that the correlations become weaker. There is thus a cumulative effect that is larger than the individual-level effect, and the individual indicators appear to render complementary effects possible. As an example, we consider the P2, P7 and P9 indicators below.

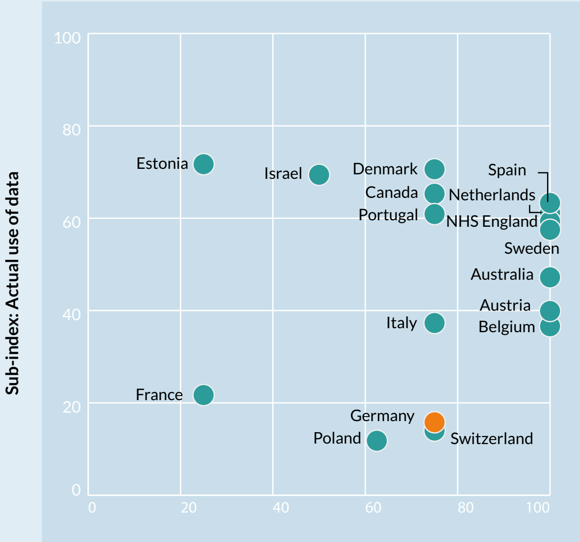
In figure 50, the individual indicators are plotted against the *actual use of data* sub-index. P2's low degree of correlation ($r=0.070$) indicates that "Political support" alone has little influence on actual data use. Other indicators too, including P7 and P9, are only weakly correlated with the sub-index ($r=0.439$ and $r=0.529$, respectively). Therefore, it appears that only the interplay of multiple indicators exerts detectable influence.

The influence of readiness-related variables on data use

"Technical implementation and readiness for data integration and use" as a sub-index is, as expected, correlated strongly with "actual data use." In other words, in order to enable the use of data, it is essential to create the infrastructural conditions necessary for digital health systems to exist. A country that represents something of an exception to this pattern is the Netherlands, which has high values for the use of data despite a comparatively low score on the infrastructure indicator.

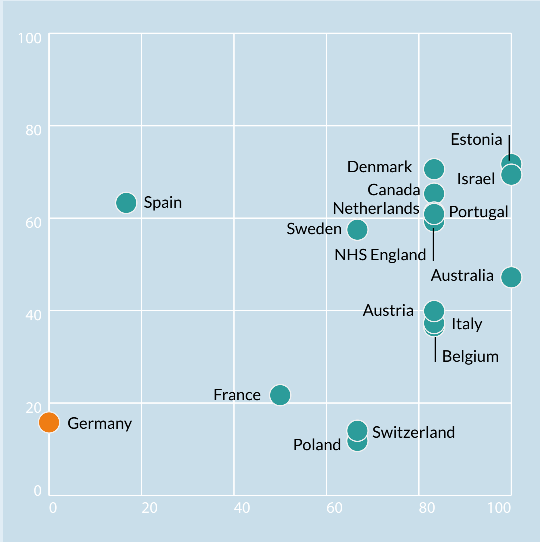
FIGURE 50: **Juxtaposition of actual data use with political support, legal oversight and financial incentives**

Indicator P2: Political support and the composite index are plotted in a two-dimensional space. Values farther toward the top and toward the right respectively represent better performances on the composite index and with regard to political support. The "Political support" indicator is composed of four questions*. The "Legal oversight of the digital health sector" indicators consists of six questions**. The "Financial incentives" indicator consists of four questions***.



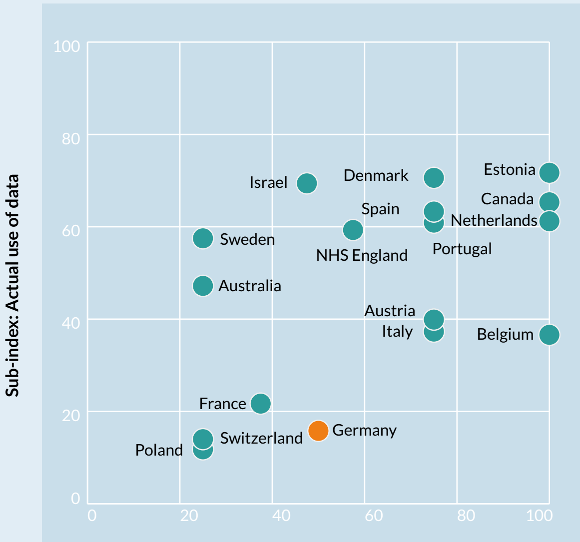
Indicator P2: Political will to support data transfer and data exchange is advanced

R^2=0.005; r=0.070



Indicator P7: Oversight of digital health implementation

R^2=0.193; r=0.439



Indicator P9: Financial incentives take up digital health

R^2=0.280; r=0.529

* 1. In your opinion, are there members of the political leadership (ministers, party functionaries, high-ranking government officials) who, in the last five years, have espoused the use of digital-health technologies and applications for the reform of the national healthcare system?
2. Has digital health played a role in the party platform of a major political party in the last five years (whether this party has been in government or not)?
3. In your opinion, are digital-health planning and implementation efforts driven by political processes and political goals (in contrast to technical projects planned step-by-step by IT/standardization experts)?
4. Are security and confidentiality concerns comprehensively addressed in the large-scale storage and referencing of data and the exchange of personal health data, and taken sufficiently into account with appropriate legislation?

** 1. Does a national public digital-health entity (management board, institute, authority) exist?
2. If yes, does this entity have oversight of digital-health strategy or investment, or the execution of the national components of the digital-health programs?
3. If yes, does it execute any organizational tasks, such as communication and dissemination of information about digital health (or digital health implementation)?
4. If yes, does the entity comment on legislation, or can it be consulted as legislation is drafted?
5. If yes, does the entity perform evaluation/assessment activities concerning digital-health applications?
6. Is there any institution which is permanently assigned the task of evaluating health (not economic) impacts from digital-health activities?

*** 1. Is there a framework or regulation allowing the use of public funding of technical infrastructure also at the point of care in general practitioners' (GP) offices and hospitals?
2. Are any compulsory technological standards being enacted, in combination with timeframes for adoption by GPs and hospitals?
3. Do regulations provide subsidies for implementing digital health technologies, or penalties for failing to do so?
4. Are there national funding/subsidy schemes that include support measures such as the provision of education and training for change management?

Source: Bertelsmann Stiftung

FIGURE 51: **Juxtaposition of the readiness sub-index and its component elements with the actual use of data sub-index**

Source: Bertelsmann Stiftung

Here, as for the three individual components addressed below, Germany again finds itself on the bottom-left edge of the empirical spectrum.

The three individual components are

- Technical implementation: Infrastructure and administration
- Maturity of digital health applications and services
- Readiness for data use and exchange: Technical and semantic interoperability

Of these three individual components, the first two are strongly correlated with actual data use, while interoperability seems to have weaker links to data use.

4.4 Cross-national summary

The digital health components collected in the survey and presented in the country reports cover a very broad spectrum. Presenting these as a whole is not possible, and in any case is a task that exceeds the scope of this study. Rather, the focus here is meant to be on the most crucial applications and services. To this end, components have been identified that are in use in most of the countries surveyed here, either at the regional or national level. Tables 33 and 34 condense the results of the country reports, and summarize the key digital health components on a cross-national basis in two steps:

1. What is technically possible/available ("ready")?
2. What digital health solutions are used for the actual exchange of data, at what level?

The portrayal of readiness takes place at two levels: the regional and the national. In the context of the Israeli healthcare system, regional means that the various digital health solutions are provided by the health maintenance organizations (HMOs).

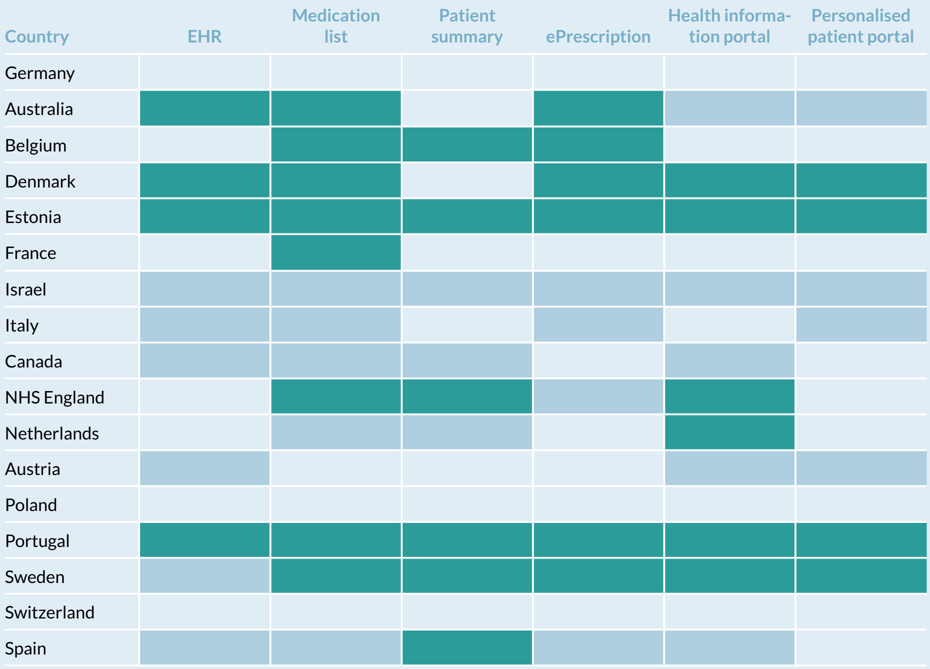
Digital health solutions in Australia enable the exchange of data at the national level, even across sectors. However, the provinces of Queensland and Victoria have boycotted the Healthdirect healthcare portal, and instead offer their own informational portals. Belgium has no EHR system, instead having only a nationally exchangeable basic dataset in the form of a patient summary and an ePrescription service.

In Austria and Denmark, electronic health records do exist, but only the inpatient care sector is connected to the system. In addition, Estonia, Sweden, Israel and Portugal have among the most well-developed digital healthcare systems. Israel's health maintenance organizations serve the country's entire population, with each offering their own digital solutions; however, information exchange between them is not yet in place.

Italy, Canada and Spain have strongly regionalized healthcare systems; thus, rather than presenting regions as a unit, this depiction instead highlights several leaders that reflect the horizon of the possible (e.g., Lombardy, Andalusia, Ontario, Quebec). In Switzerland, the EPD system has not been introduced nationally, as it is still in the implementation phase. In Austria too, additional digital health applications will be launched in the near future.

A digital health solution or service can be available to all healthcare providers in a country. However, only a potential degree of uptake can be inferred from this. The actual use is dependent on various other factors such as the availability of broadband connections and

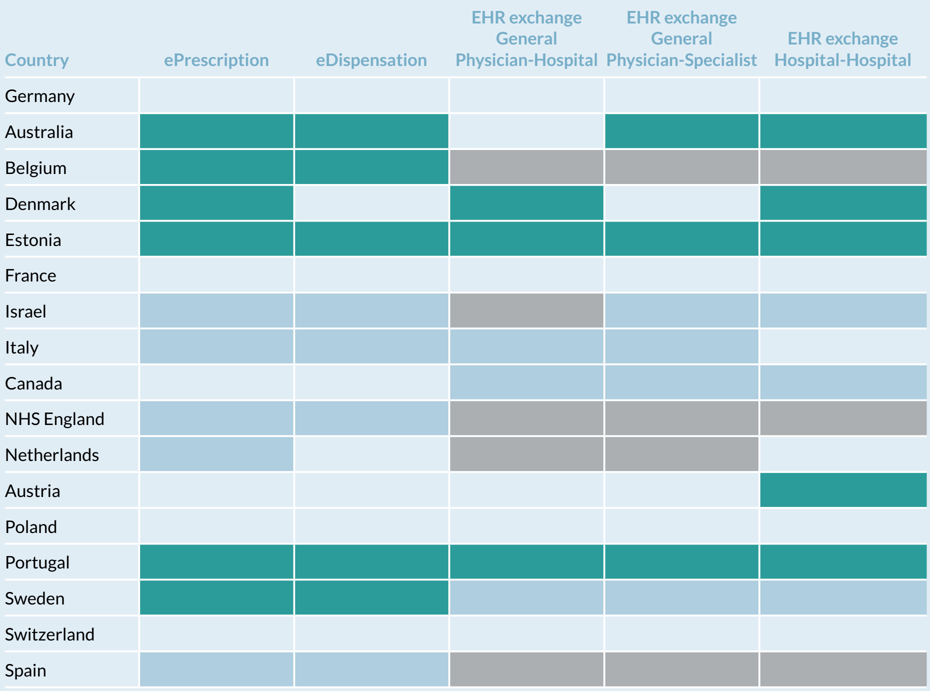
TABLE 33: **Country matrix, readiness of key digital health solutions**



Regionally / health insurer based (HMO) available ■ available nationwide

Source: Bertelsmann Stiftung

TABLE 34: **Country matrix, actual use of key digital health solutions**



Regionally / health insurer based (HMO) available ■ exchange via patient summary ■ available nationwide

Source: Bertelsmann Stiftung

financing options, and the degree of technical interoperability. Entire health sectors in some countries (e.g., Denmark) have different IT systems, and thus cannot exchange data across sector boundaries using existing capabilities, or can do so in only a limited way. Table 33 shows the levels at which ePrescription or eDispensary services and data exchange using an EHR system is possible. In addition to this "national" and "regional" distinction, it should be recalled that care providers in certain countries exchange patient summaries rather than EHRs on a cross-sectoral basis.

In Australia, the ePrescription program is the most widely used service on the national level. Healthcare data is exchanged between care providers using the EHR system, but with a rather low frequency. In Belgium, England's NHS system and Spain, the exchange of data takes place solely in the form of patient summaries. Patient summaries in Spain can even be exchanged across regional borders. Even within a single Israeli HMO, a hospital physician can access only the summary of an EHR, not the entire electronic record.

Looking at the table, it is striking that more than half of the countries studied have introduced a quite advanced ePrescription service. Not only are the prescriptions issued electronically, the dispensation process itself is also digitized: Pharmacies can use the service to call up the electronic prescription, subsequently saving information about the dispensing process in the system.

In this final chapter 4.4 of the benchmarking results, the key interim findings of the individual country reports and the Digital Health Index are condensed, and the most important digital health components are summarized on a cross-national basis. This enables the production of clear country matrixes for a) assessing technical readiness, along with the study's real innovation potential, and b) answering the question of what digital health solutions are actually used to exchange patient data. As an overview, this chapter presented the Digital Health Index and its results in the form of various country rankings, summarized the results of Part I, and illustrated these results with a number of graphs showing the cross-national benchmarking results.

This chapter concludes Part I of this study. The following Part II, *Criteria for success and the degree of use of digital applications – Comparative country study* will now proceed on a more qualitative basis, thus addressing the question of *why* one country may show greater digitalization success than another. Possible candidates for success criteria with regard to digitalization in the healthcare sector will be identified on the basis of detailed country studies for Switzerland, the Netherlands, Denmark, Israel and France.

Part II:
Success criteria and utilisation rates of digital applications

In-depth country study

Switzerland, Netherlands, Denmark, Israel and France

5 Central research question for the country comparisons

Part I of this report draws upon a broad cross-national comparative analysis to create a benchmarking system and index of development for the digital-health sector. By contrast, Part II has the goal of identifying political, cultural and institutional criteria for success, as well as the actual degree to which digital applications are used, and draws on in-depth country studies examining Switzerland, the Netherlands, Denmark, Israel and France. Our central research question asks exactly why some countries are more successful than others in their digitalization efforts.

A key hindrance in understanding the extent of digitalization takeup within a regional or national healthcare system is the present lack of comparative causal analyses of why various digitalization and implementation efforts yield successful outcomes in some countries but do not in others. In this regard, the following questions play a leading role:

- Are there differences in structural conditions; in political actors' and stakeholders' preferences, political equilibria and power structures; or in cultural factors?
- What role does the type of political system play – for example, with regard to federal structures, or consensus versus majoritarian principles?
- How is the healthcare system embedded in the economic and political system?

There are a number of reasons why the digitalization of public services – in this case, the public healthcare sector – may progress slowly. Many explanations focus on the structural aspects of public institutions and their ability to implement digital tools. Others emphasize citizen acceptance as the key to technical solutions in the public sector.

To accurately understand the underlying national conditions and political activities relevant to this in-depth country study and healthcare-system comparison, we have had to engage in a somewhat more extensive data-acquisition process, including our own surveys. The study team thus visited all five countries and conducted between two and six exploratory expert interviews in order to understand local conditions in greater detail, and to learn what success criteria and barriers have played a role in the country's current and historical digitalization efforts. These interviews focused particularly on actor-oriented activities, the role of institutions in the digital-health development process, and the influence of the political processes. Our interview subjects included representatives of national digital-health authorities, ministries, care providers and trade associations, as well as independent experts.

The study trips were preceded by a literature review based on desk research conducted as part of the benchmarking study. This in turn served as a starting point for discussions and research questions for the five countries. Using this literature review as a basis, we developed a political impact model in order to highlight the anticipated effects of individual factors (e. g., political system, financing system, role of veto actors, or the cultural significance of data protection) on the state and success of digitalization, and thus rendering the process of digital transformation more comprehensible.

One challenge in the creation of this impact model was the integration of social-science and political-science variables into a study field more often addressed from an economic or technical perspective. However, we recognized that making a solid analysis of the potential for transfer to the German healthcare system only would be possible if we were able to understand the relevant political systems, national institutions, actors and background conditions, and identify their influence on healthcare-system digitalization.

Building on the results of the team's interviews, the data was analyzed against the background of the impact model, and the information from the various countries was compared. Characteristics specific to each country's political- and healthcare-systems were identified, along with the impact of digitalization strategies, institutional factors and cultural factors. Each factor's effect on the state of digitalization was analyzed.

The results serve as the basis for Part III's comparative evaluation of success criteria and inform our analysis of the potential for transfer to other countries and healthcare systems. Our results are intended to provide impetus with regard to driving healthcare-system digitalization farther and faster in Germany, as well.

The five countries surveyed in depth, including Switzerland, the Netherlands, Denmark, Israel and France, are also part of the benchmarking country group in Part I of this report. Some of the basic information and data contained there is briefly reiterated in Part II's five country chapters in order to ensure a better reading flow, and to provide the country analyses with a complete, standalone character.

6 Country comparison and impact analysis

6.1 Switzerland

6.1.1 State of digitalization

The state of digitalization in Switzerland is regionally heterogeneous. In practice, the cantons have the sovereign power to decide how fast they want to implement digital-health projects. Currently, more than half of the cantons have provided evaluations of projects related to the Electronic Patient Dossier (EPD) program to the eHealth Suisse coordination bureau.[345] All cantons are addressing the issue of digital health. In some cases, individual cantons have merged their efforts in this area in order to form larger EPD-related eHealth communities (see below for more information on these communities).[346]

The EPD system has not yet reached fully operative status in any canton. The electronic medication-list system is to be tested with initial pilot projects in 2019 and implemented more broadly in the following years.

Various eHealth Suisse working groups have been responsible for technical and semantic interoperability between the four major data-exchange formats, including the EPD system, an electronic medical-results system (laboratory results, diagnostic results, x-rays, etc.), an electronic vaccination dossier, and an electronic medication record. Between 2015 and 2017, a number of reports and recommendations were published.[347]

The electronic vaccination dossier was implemented in 2014, and should be available through the EPD system in the future. After creating their own accounts, residents of Switzerland can access information on treatments, vaccination histories and upcoming vaccination appointments through this service.[348]

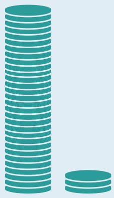
345 Pietro, C. D. and Francetic, I. (2018). E-health in Switzerland: The laborious adoption of the federal law on electronic health records (EHR) and health information exchange (HIE) networks. *Health Policy, 122* (2), pp. 69-74.

346 GDK, Schweizerische Eidgenossenschaft, (2017). *Elektronisches Patientendossier (EPD)– Aktivitäten in den Kantone.* Bern. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180508_Stand_eHealth_In_den_Kantonen_def_d.pdf

347 eHealth Suisse. (2015). *Austauschformat eImpfdossier.* Bern. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180507_CDA-CH-VACD_de.pdf

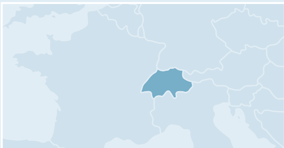
348 meineimpfungen.ch, (2018). *The Swiss electronic vaccination record.* [online] Available at: https://www.meineimpfungen.ch/about.html

FIGURE 52: **Switzerland country profile**



Politics, culture, healthcare system

8.37 million inhabitants



41,285 km² area

Political culture
- 26 cantons
- Federalism
- Public referenda

Healthcare system type
- Mandatory insurance
- Per capita premiums, not income-based

Actors & institutions
- eHealth Suisse
- GDK
- FMH

Digital-health expenditures
- € 26.6 million in initial start-up financing for EPD program
- € 2.63 million expended for eHealth Suisse

Digital-health governance

Strategies and laws
- EPD law
- Switzerland eHealth Strategy 2.0

Institutional anchoring
- eHealth Suisse, a coordination bureau working under the Federal Office of Public Health
- eHealth framework agreement

Political leadership
“Political leadership in Switzerland consists primarily in getting out of the way.”

Digital Health Index

Score: 40.6

1 2 3 4 5 6 7 8 9 10 11 12 13 **Rank 14** 15 16 17

Source: Bertelsmann Stiftung

Patient identification numbers assigned by the Central Compensation Office (ZAS) are stored in the master patient index maintained by the EPD-related healthcare communities and eHealth communities. These numbers allow patients to be identified and granted access to the EPD system through the access portal.[349]

eHealth Suisse offers two different forms of information and further-education materials for the general population and for healthcare professionals. The “Guidelines for Training Managers” brochure is designed as a tool for lecturers in colleges and training institutions with which they can acquaint future personnel with the topic of electronic health in general, and with the EPD system in particular. An eLearning platform with general information on the EPD program is being set up on the eHealth Suisse website. Because the actual degree of implementation varies significantly from canton to canton, they share responsibility for more specific services with the EPD healthcare communities.[350] One such eLearning course, aimed at project leaders and all other persons involved in introducing the EPD system within Swiss hospitals, has been available at the University Hospital Basel since December 2017.[351]

349 eHealth Suisse, (2017). *Arbeitsgruppe „technisch-semantische Integration EPD“.* Bern. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/170413_AG-technisch-semantische-Integration-EPD_d.pdf

350 Fachhochschule Bern, (2017). *Konzept eLearning-Angebot zum elektronischen Patientendossier EPD.* Bern. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/170912_Konzept_eLearning-Angebot_EPD_def_d.pdf

351 easylearn.ch, (2015). *Neues e-Learning zum elektronischen Patientendossier (EPD) und wie Sie Ihr Spital daran anschliessen.* [online] Available at: http://www.easylearn.ch/news/641-sue-fuehren-sie-das-elektronische-patientendossier-epd-erfolgreich-ein.html

6.1.2 Structures and characteristics

Country characteristics

Switzerland has 8.37 million residents, distributed across 26 cantons and a 41,285 km^2 surface area. Switzerland's administrative divisions can be viewed historically as deriving from the combination of sovereign states into a federal state. Due to these historical circumstances, the cantons retain a high degree of autonomy today, even down to the level of individual local governments. Federalism and subsidiarity are very strongly pronounced in Switzerland. This concept is bolstered by the country's direct-democratic practices. Thus, the people, the municipalities and the cantons are involved in virtually all phases of political decision-making. This popular self-determination is reflected in a rather conservative overall approach. Switzerland has a long history of risk selection; thus, the population and general political culture tend to exhibit a distinct distrust of centralized positions of power.

Switzerland's governance system is characterized by a directorial system and concordance democracy. From an organizational perspective, the Federal Council represents the government (the directorate) at the federal level. The seven Council members, each with equal power, are selected according to the parliament's principle of collegiality. In this selection process, the parliament can disregard the parties' candidates in order to create a government with the greatest possible amount of consensus. However, the government acts independently of parliament, and cannot be dissolved. There is no structural necessity for coalitions or official opposition parties. Because the Federal Council, like the cantonal and municipal governments, is a collegial authority, internal majorities are represented externally as government policy. In this regard, it can happen that one of the government parties may temporarily oppose the government. However, this does not mean that the Federal Council must resign. Nor is this necessary if the results of a public referendum run contrary to the government's policy. The forces defeated in a vote must subordinate themselves to the council or the people's will, and allow their future government work to be determined by the decisions thus made. Concordance requires all members to demonstrate a strong ability to achieve consensus, as the government's ability to act can otherwise be altogether blocked.

The two-chamber Swiss parliament, the Federal Assembly, consists of the National Council and the Council of States, respectively the representatives of the federation and the cantons. The passage of legislation at the federal level requires approval by both parliamentary

TABLE 35: **Networked Readiness Index 2016**

	2015 Rank		2016 Rank
Netherlands	4	↓	6
Switzerland	6	↓	**7**
Denmark	15	↑	11
Germany	13	↓	15
Israel	21	→	21
France	26	↑	24

Source: Baller, S., Dutta, S. und Lanvin, B. (2016). The Global Information Technology Report 2016 – Innovating in the Digital Economy. World Economic Forum, Genf.

chambers The country's distinctly multilayered balance of power also comes clearly into view here, as the federal level is empowered to legislate only in areas expressly identified by the federal constitution.

Under these conditions, legislative activities appear lengthy and relatively complicated. In Switzerland's consensus-driven political system, regional and local sensitivities play a strong role, as do the diverse veto options resting with the Federal Council, the National Council, the Council of States, and the further possibility of optional referenda with the retrospective power to overturn parliamentary decisions. With regard to the Federal Law on the Electronic Patient Dossier (EPDG), it is notable that outpatient physicians threatened to bring a referendum in opposition to the program.

Switzerland is ranked at 7th place in the NRI, one rank behind the Netherlands. This result suggests that good to very good conditions exist in Switzerland for the use of emerging ICT and for capitalizing on the opportunities presented by the digital transformation. The requirements for digital-health systems are certainly in place, even if the current state of digital health might indicate a lower result.

Political culture

Switzerland's political culture is characterized on the one hand by federalism and a high degree of subsidiarity, and on the other by the population's broad legal right to have a say on matters of public policy. Historically speaking, Switzerland has a long history of risk selection; thus, levels of public trust in many public and private institutions are low. The historical experience of self-determination often leads cantons to be strongly defensive of their own competences. Citizens too show a certain degree of individualism and lack of trust in institutions. With regard to the healthcare system, this means that the Swiss have a particularly low level of trust in their insurers. The fear here is that insurers may gain advantages relative to citizens using healthcare data as a basis. Unfortunately, the Eurobarometer survey offers no evidence on the issue of data protection for Switzerland; however, experience suggests that worries about the misuse of data are quite prevalent here.[352]

Type of healthcare system

Switzerland has had a comprehensive compulsory health-insurance program for the entire population since 1994: the so-called "obligatorische Krankenpflegeversicherung" (OKP; obligatory health insurance). Within their cantons, insured individuals can choose freely between the various private insurance companies. The 61 insurance companies that were in operation in the year 2013 are obliged to extend coverage without regard for pre-existing conditions.

Switzerland's healthcare sector is organized on a federal basis. The federal government is responsible for the area of health insurance, and further oversees the quality and safety of medicines and public health, as well as training programs for the sector's employees. By contrast, the coordination of healthcare providers, including hospital planning and the accreditation of outpatient-care service providers, takes place at the cantonal level. Consequently, strategic development in the healthcare sector is a joint undertaking involving both the federal level and the cantons.

352 Interview, Switzerland study trip

Switzerland financed its healthcare sector in 2015 at a rate of 11.5 percent of its GDP, making it one of the most expensive systems in the world. Particularly striking here is the share represented by copayments, with 26 percent of all expenditure financed by the patients themselves. The healthcare system is similar to other compulsory insurance systems in Europe, but is not designed as a social-insurance system. The system's financing takes place through per capita premiums, and is thus independent of income levels, in contrast to traditional social-insurance systems.

The size of the per capita premium varies greatly between children, young adults and adults, as well as between cantons and insurance companies. The premiums are paid exclusively by the insured individuals themselves, as there is no employer participation. A premium-reduction program supports socially weak families. The Swiss health-insurance system additionally includes a deductible amount to be paid by the patients, which has been significantly increased in recent years in order to counterbalance the state's rising OKP spending. For example, adults are responsible for paying all costs up to CHF 300; after that point, the insured pays 10 percent of the costs up to a maximum of CHF 700, with the OKP covering the remainder. Thus, the annual deductible can amount to as much as CHF 1000. Insured persons can decide to accept a higher deductible in return for paying lower premiums.

The OKP services are legally regulated, but are somewhat less comprehensive than those provided under the German statutory health-insurance (GKV) program. In particular, dental treatment and sickness benefits are not included in the catalog of services, and must be provided for privately.

As in Germany, outpatient medical care is provided primarily by outpatient physicians, usually in individual practices. Patients have a fundamental right to choose their doctors. However, patients who enroll in practice networks or general-practitioner systems can receive discounts on their premiums. Those who select this alternative are limited to visiting network-connected care institutions. In 2010, 46 percent of adult Swiss selected this option. Inpatient care is overseen by the cantons, which operate most of the clinics at the regional level. They finance investment costs and 50 percent of the operating costs for hospitals.

Digital health expenditures

As yet, the country has no public budget for digital-health purposes. All eHealth Suisse activities are financed by the federal government and the cantons. Healthcare service providers must commit a portion of their budget for the introduction and operations of the EPD, but can also obtain financial support from their EPD healthcare community. In addition to the healthcare-community co-financing, penalties have been established for the hospitals if they fail to comply with the implementation timetables.[353]

The federal government is providing the eHealth communities with € 26.6 million in start-up financing.[354] In addition, an annual allocation of € 2.63 million is made for eHealth Suisse, jointly financed by the federal government and the Swiss Conference of the Cantonal Ministers of Public Health (GDK).

353 Interview, Switzerland study trip
354 eHealth Suisse, (2017). *Informationsbroschüre für die Bevölkerung. Meine Gesundheitsinfos. Zur richtigen Zeit am richtigen Ort.* [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/171219_EPD-Broschuere_Bevoelkerung_d.pdf

Actors and institutions

The Federal Council is Switzerland's federal government and is thus the highest governing executive authority at the federal level. The seven equally ranked council members, each of are chosen by Federal Assembly, conduct all business in common according to the principle of majority rule. However, each member presides over one area (department) of the federal administration (under the departmental principle), comparable to other country's ministries.

The Federal Department of Home Affairs (FDHA) consists of eight subordinate agencies, and is responsible for a variety of areas including social security, culture, health, and gender and ethnic-group equality. The FDHA is the highest national authority for decisions relating to the daily functioning of the health-insurance system, reimbursements for the provision of healthcare services, and medicinal-product pricing and reimbursement rates. However, most of the administrative work, as well as the preparation of legislation and regulations, is performed by the Swiss Federal Office for Public Health (FOPH). The FOPH can be compared with other countries' health ministries with regard to competences and function, and prepares healthcare-related legislation at the national level. For example, it submits proposals to the FDHA regarding the selection of services to be included in or excluded from the OKP, and how these should be paid for. It also manages the federal government's insurance-premium subsidies (for the cantons), a sum totaling nearly €2.07 billion in 2015, and defines regulations and laws relating to the training of medical professionals. The current head of the FOPH (as of 2018) is Pascal Strupler.

The cantons have their own independent health ministries with a decreasing, but nevertheless relatively high degree of influence on the provision of healthcare services within their cantonal borders. Their competences cover areas that are not identified as federal responsibilities by the constitution. However, even when federal legislation is in place, the cantons have a certain amount of autonomy with regard to the implementation of laws and other ordinances, which typically require additional canton-level laws to be implemented. Cantons are generally responsible for ensuring that healthcare infrastructure is in place. Thus, most hospitals are operated by the cantons, with up to 50 percent of the ongoing inpatient-care costs funded by the cantons. They also set the various premium and subsidy levels paid or received by the insured population, and are responsible for the licenses needed by healthcare professionals to operate at the local level. Finally, they also handle tasks related to prevention and food safety.

Local and city governments play a rather minimal role in the healthcare sector. Larger municipalities (>50,000 residents) generally take on key tasks in ensuring the provision of healthcare in the canton. They also play a larger role than smaller towns in providing long-term care for vulnerable groups such as senior citizens.

eHealth Suisse is Switzerland's national competence and coordination center. As such, it is both a facilitator and motivating force for the managed introduction of digital healthcare solutions based on national standards (such as Integrating the Healthcare Enterprise (IHE) or Health Level Seven (HL7)). The authority was founded in 2008 by the federal government and the cantons, primarily to manage the ongoing implementation of the country's eHealth strategy. The federal government itself does not have sufficient legal standing to implement the Swiss eHealth strategy on its own. Each canton is responsible for its own digital-health policy. Thus, each canton produces its own legislative corpus, including healthcare laws, patient rights, data-protection provisions, professional law and so on.

Consequently, implementation of the Switzerland eHealth Strategy necessitates close cooperation between the cantonal and national levels. The decentralized implementation projects are dependent on frameworks, components and services across the country. The federal government is responsible for a portion of these, carrying them out itself. Other implementation projects are developed on the basis of legal guidelines or are privately initiated. eHealth Suisse continues to develop guiding technical and organizational principles. The eHealth Suisse steering committee has commissioned six sub-projects, which have in turn gradually adopted a variety of recommendations. After the EPDG came into force in April 2017, the Federal Office of Public Health and the GDK tasked eHealth Suisse with enforcement responsibilities in the sense specified by articles 12, 15 and 18 of the EPDG.

A total of 83 percent of the public sector's contributions to the healthcare sector stem from the cantons. This is in large part because the cantons are reluctant to transfer additional competences to the federal level. For example, they have to date resisted the development of a supra-regional or national hospital plan, and have opposed a reorganization of hospital financing that would diminish their planning competences. As a means of countering any further centralizing tendencies, the 26 cantons have intensified their cooperation through the GDK, an organization founded in 1919. The aim is to improve coordination between the cantons themselves, as well as with the federal government. The federal government, along with Lichtenstein, has the status of a permanent non-voting member at the GDK's twice-annual plenary meeting. Generally speaking, the GDK's decisions are viewed as recommendations rather than being legally binding. However, participating parties did agree in 2009 to give the new inter-cantonal Conference for Highly Specialized Medicine (HSM) a legally binding character. Thus, all cantons must comply with the HSM's directives with regard to the allocation of competences, the creation of plans, and funding in the area of complex, highly specialized medicine.

Since 1998, the National Dialogue on Healthcare Policy (NDHP) has provided a joint forum for the federal government and the cantons to discuss current topics of mutual interest in the healthcare sector. The NDHP serves as a forum for the regular exchange of information; the identification of healthcare policy topics and tasks in which the federal and cantonal governments have a common or complementary interest in coordinated development; the determination of necessary fundamental, preparatory and development work; the adoption of joint statements and recommendations to the federal and cantonal governments; and the promotion of mutual understanding and trust. Jointly coordinated projects such as dementia or eHealth strategies are disseminated here in a focused way. The federal and cantonal governments also jointly operate the Swiss Health Observatory (Obsan), which analyzes available health-related information in Switzerland and provides statistical information and advice to the federal and cantonal governments and other institutions for the purposes of long-term healthcare planning.

The introduction of the EPDG has led to the formation of technical associations called "healthcare communities" ("Gemeinschaften") have formed, which can be organized across cantonal borders. These EPD healthcare communities can emerge in a decentralized manner to serve a particular region, for example in one canton or spanning several neighboring cantons. All healthcare professionals and their institutions can join these communities – thus, hospitals, nursing homes, doctors' practices, pharmacies, home-care services and other medical professionals. Some EPD healthcare communities enable patients to open their personal electronic patient dossiers. Such EPD communities are called eHealth communities ("EPD-Stammgemeinschaften"). eHealth communities must provide a patient access portal that allows patients to review their EPDs and manage healthcare professionals' access to their documents. Patients can freely choose where they want to open their EPDs.

The Foederatio Medicorum Helveticorum (FMH), or Swiss Medical Association, represents 95 percent of Switzerland's physicians, and has more than 40,000 members. It is also the umbrella group for more than 70 smaller physicians' associations, including canton-level groups and the professional associations for resident, chief resident and senior hospital physicians, as well as other specialist associations. The association is the voice of the Swiss medical profession, and advocates both for the regulated provision of healthcare services and for optimal professional conditions for its members. It places particular focus on promoting training, education and continuing-study programs, and on ensuring the education sector's long-term health. The FMH also plays a key role in the ongoing development of tariff structures, as well in the benefit-oriented, national implementation of digital-health services.

The Swiss Society for Medical Informatics (SGMI) is an association that promotes the study, development and use of informatics in the healthcare sector. The SGMI is a constituent member of the European Federation for Medical Informatics (EFMI), which in turn belongs to the International Medical Informatics Association (IMIA). It represents Switzerland in the EFMI. The SGMI has been in existence for more than 20 years, and is an interdisciplinary association of experts who engage with ICT in the healthcare sector as a part of their profession. Commissioned by eHealth Suisse, SGMI produced a report called *eHealth 2025* as an input paper for the renewal of the national eHealth strategy through 2025.

6.1.3 Digital-health governance

Strategies and laws

Switzerland's current digital-health strategy, *eHealth Schweiz 2.0* (hereafter *eHealth Switzerland 2.0* or *eHealth Strategy 2.0*), has been in effect since the spring of 2018. The Federal Council commissioned the 2.0 strategy in 2016, with the launch of the *Digital Switzerland* action plan. The project was supported by the GDK, and the strategy for the 2018-2022 period was developed by a working group that included representatives from the federal and cantonal levels. It was approved in early 2018 by the GDK and its national plenary meeting, and published on 1 March. Specific measures aimed at achieving the various identified objectives are being developed in conjunction with the relevant actors through the end of 2018.[355]

The focus of the digitalization efforts has been on the development of a national EHR system and regional heath-information portals. Because digitalization efforts in Switzerland take place at the regional or cantonal level, but data exchange between cantons is also intended to take place, the *eHealth Strategy 2.0* specifies additional measures for an interoperable digital healthcare system. In order to facilitate implementation of these goals, lawmakers have defined initiation plans, implementation assistance and sanctions for non-compliance with these plans. Using initial draft legislation as a basis, the economic

355 eHealth Suisse, (2018). *Strategie eHealth Schweiz 2.0 2018-2022.* eHealth Suisse. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180214_Strategie_eHealth_2.0_Version_Dialog_NGP_d.pdf

TABLE 36: **Switzerland's digital-health timeline**

Year	Strategy
1998	Strategy for an Information Society in Switzerland
2007	eGovernment strategy
2007	Switzerland eHealth Strategy
2008	Founding of eHealth Suisse competence and coordination center
2009	Federal Quality Strategy for the Swiss Healthcare Sector
2012	Strategy for an Information Society in Switzerland
2013	Health Strategy 2020
2015	Adoption of EPD law
2018	Switzerland eHealth Strategy 2.0

Source: Bertelsmann Stiftung

impact of a national EPD system was evaluated in advance; this determined that such a system would have a positive impact on the quality of care.[356]

The EPD system, which was adopted through the EPDG in 2015 and came into effect in 2017, constitutes the core of Switzerland's current digitalization efforts. With the revision of the Regulation on the Electronic Patient Dossier (EPDV), which came into effect on 1 March 2018, provisions relating to the accreditation of certification bodies and to the census of working healthcare professionals were adapted to the survey on healthcare institutions and healthcare professionals. In addition, the second edition of Annex 8 of the Technical and Organizational Certification Requirements for Electronic Authentication Means and Their Issues (EPDV-EDI) came into force on 1 April 2018. All necessary adjustments in the technical specifications (integration profile) and metadata will be made in future revisions of the EPDV-EDI. The first data-exchange formats (the electronic vaccination dossier, the electronic laboratory-findings system, and the electronic medication list) will also be introduced at this time. The federal government will then adopt the revised version of the EPDV-EDI, as well as the provisions contained in EPDV-EDI annexes 2, 3, and 5, once all the technical concepts involved have been proved to function satisfactorily. This is expected to take place in mid-2019.[357]

Institutional anchoring

As the EPD system is introduced, the Swiss government is providing the cantons with co-financing in the amount of CHF 30 million for the purpose of establishing eHealth communities. The cantons must match this with a further CHF 30 million or lose access to the state support. These funds cannot be used to fund technical upgrades in hospitals.[358] eHealth Suisse is Switzerland's coordinating body, standing between the federal govern-

356 Dobrev, A., Rissi, C., Marti, M., Stroetmann, K.. (2011) *Regulierungsfolgenabschätzung zum Vorentwurf des Bundesgesetzes über das elektronische Patientendossier.* Report to the Federal Office for Public Health and the State Secretariat for Economic Affairs. Bern. [pdf] Available at: https://www.bag.admin.ch/dam/bag/de/dokumente/nat-gesundheitsstrategien/strategie-ehealth/vernehmlassung-vorentwurf/schlussbericht-epdg.pdf.download.pdf/.pdf

357 eHealth Suisse, (2018). *Erläuterungen zum Einführungsplan Elektronisches Patientendossier. Bern.* [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180531_Erlaeuterungen_Einfuehrungsplan_d_def.pdf

358 CURAVIVA, (2014). *Strategie eHealth Suisse/ Elektron. Patientendossier. Ziele und Umsetzung – Erkenntnisse – Handlungsbedarf.* Bern. [pdf] Available at: https://www.curaviva.ch/files/R3VJU8A/Ziele-Umsetzung-Erkenntisse-und-Handlungsbedarf-von-eHealth.pdf

ment and the cantons. As such, it holds ultimate responsibility for the introduction of the EPD system. It is funded in equal parts by the federal government and the cantons.[359, 360] In previous years, the organization helped develop a new legislative framework, and played a key role in the successful adoption of the Federal Law on the Electronic Patient Dossier in 2015. eHealth Suisse was founded due to the federal government's lack of authority in this area, and is in part a result of the first eHealth strategy.[361]

Its primary instruments are transparency and the transfer of knowledge. The cantons make regular voluntary reports regarding the state of EPD implementation. There is no power associated with these coordination functions as such; however, this coordination is important for all EPD eHealth communities, because it is ultimately of great importance for the patients that EPDs accessible online have a unified appearance.[362]

Since the EDPG came into effect in 2017, eHealth Suisse has also assumed an enforcement role in the areas of certification, standards and interoperability, all in cooperation with the cantons. It additionally carries out public-communications functions. These areas of responsibility are governed by the *eHealth Framework Agreement* between the Department of Home Affairs and the Conference of Cantonal Ministers of Public Health.[363]

By 2020, all hospitals must be a part of a certified eHealth community. Failure to comply will result in hospitals being dropped from the official hospital list, thus losing eligibility for reimbursement for their treatments. In reality, it is likely that some will not yet be fully integrated. However, as long as the hospitals are moving in the right direction, this fact will probably not be cause for sanction.[364]

Political leadership

According to the definition of political leadership,[365] observers must look at the role played by top political-executive figures in consensus development and decision-making processes, along with government decisions on the issue of Switzerland's digital-health programs. In this regard, it must again be noted that the federal government has only very minimal competences with regard to shaping the healthcare system. To be sure, there are many incentives for the federal government to take on additional competences. However, due to its weak constitutional position, it would be unable to secure parliamentary funding.[366]

Due to the lack of federal-level competences, political leadership in Switzerland can be regarded as all but absent with regard to digital health; indeed, it consists primarily in

359 Swiss Federal Department of Home Affairs (FDHA)
360 Swiss Conference of the Cantonal Ministers of Public Health (GDK)
361 Interview, Switzerland study trip
362 Ibid.
363 GDK, Schweizerische Eidgenossenschaft, (2017). (2017). *Rahmenvereinbarung über die Zusammenarbeit im Bereich "eHealth" ("eHealth" Vereinbarung).* Bern. [pdf] Available at: https://www.gdk-cds.ch/fileadmin/docs/public/gdk/themen/ehealth/beschluesse/ehealth-rahmenvereinbarung_20111027_d_sign.pdf
364 Interview, Switzerland study trip
365 See chapter 2 for the definition of political leadership. With regard to the central government, political leadership is conceived as the direction of governmental decision-making processes and the production of political legitimacy for government decisions by top figures in the political executive (Jean Blondel, Political Leadership: Towards a General Analysis, London 1987). Other approaches to "political leadership" inquire into the conditions providing political leaders with strong implementation capabilities, and where appropriate, examine opportunities for optimizing political leadership performance (Helms, L. (2009) Politische Führung in der Demokratie: Möglichkeiten und Grenzen der vergleichenden Forschung. *Zeitschrift für Politik.* 56, p. 375 -396).
366 Ibid.

getting out of the way, so to speak. The head of the FOPH, and indeed the topic of Digital Health itself, are rarely mentioned in the public discourse. Switzerland functions in the opposition between decentralization and conservatism on the one hand, and implementation and transformation networks on the other. Ultimately, there has been little political leadership by the relevant minister (the head of the FOPH). In addition, digital-health issues have to date played no role in the political programs of the individual parties or in elections.[367]

However, as a positive argument for political leadership, the development of the original *eHealth Strategy* deserves mention. As the presence of an orienting framework is of fundamental importance under Switzerland's complex political conditions, the first strategy was necessary in order to make the EPD program possible at all. Accordingly, it triggered early discussions and helped shape opinions as the program was conceived. One outcome was the formation of eHealth Suisse as a body tasked with coordinating the participating stakeholders.[368]

6.1.4 Impact analysis

Below, we will address the observed influence of various variables on Switzerland's digitalization process.

The following observations were made regarding individual variables:

Country and population size: In Switzerland, the size of the country and the number of residents have neither a positive nor a negative effect on digitalization. Although the country is rather small, it derives no benefits from this due to the strongly pronounced federalism. Observed effect: 0

State and government form: The state and government form has neither a positive nor a negative effect on the state of state of digitalization. Observed effect: 0

Political order: Centralism vs. federalism and subsidiarity: Contrary to the assumption that a comparatively pronounced federalism such as Switzerland's would have a negative impact, a slightly positive effect was noted. Observed effect: +

Corporatism (degree of self-government): Contrary to our assumption, a positive effect on digitalization was found either despite or because of the degree of self-government. Observed effect: +

Compromise and consensus: The population's strong co-determining voice in setting public policy, along with the high degree of federalism, forces decisions to be made by consensus under threat of future referenda. This is fundamentally observed to have a positive effect. Observed effect: +

Role and cultural embeddedness of data privacy and data protection: Due to the population's concerns regarding the role of insurers, not all actors can be connected to the EPD system. Observed effect: −

Financing system: Social-insurance system (Bismarck) vs. state-run health service (Beveridge) vs. hybrid system Financing for the healthcare system in Switzerland functions on the basis of a per-capita, non-income-based premium. No direct positive or negative relationship with the degree of digialtization can be observed. Observed effect: 0

Regional / municipal vs. national organizational structure: In Switzerland, the federal government is responsible for health insurance and public health, while the cantons are responsible for the

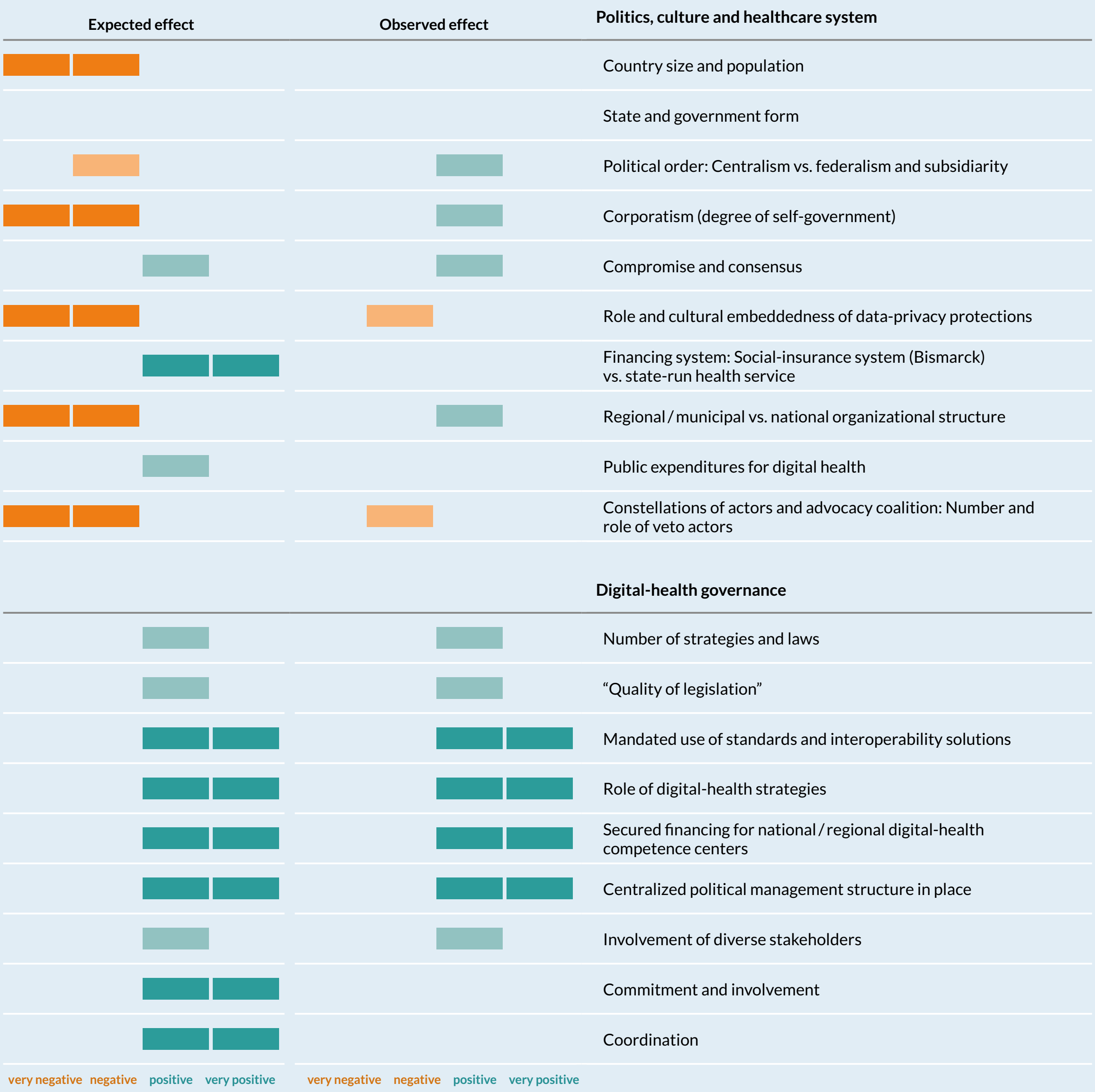
367 Ibid.
368 Ibid.

coordination of healthcare providers, hospital planning and the accreditation of outpatient service providers. This clear division has a positive effect. Observed effect: +

Public expenditures for digital-health issues: Direct public-expenditure levels are relatively low in Switzerland. The expenditures made achieve good effect; however, financing for the EPD system beyond its start-up funding remains unclear, for example. Observed effect: 0

Actor constellations and advocacy coalitions: Due to the strength of veto actors – for example, the threat of a referendum called by FMH – this variable has a negative effect on digitalization, as assumed. Observed effect: –

FIGURE 53: **Expected vs. observed effect of influencing variables on the state of digitalization – Switzerland**



Source: Bertelsmann Stiftung

Number of strategies and laws: Switzerland has laid a solid foundation for digitalization with its general digitalization strategy, its first and second eHealth strategies, and the EPD law. This has a positive effect. Observed effect: ⊕

Quality of legislation: The EPDG is generally deemed a "lean, simple" law. Actual implementation is taking place via a framework regulation. A positive effect is evident here. Observed effect: ⊕

Binding application of standards and interoperability solutions: The uniform certification standards contained in the EPDG, along with the "projectathons" intended to implement these without prescribing specific software, have had a very positive effect. Moreover, the necessary definitions of interoperability for the EPD system are in place. Observed effect: ⊕⊕

Role of digital-health strategies: "In the context of the strategy, absolutely central principles were laid down that could not be called into question in the future course of events." This high-quality groundwork, performed at a very early stage, resulted in a very positive effect. Observed effect: ⊕⊕

Secured financing for national / regional digital-health competence centers: The expenditure for the institutional establishment of eHealth Suisse has had a very positive effect on digitalization. Observed effect: ⊕⊕

Central political management installed: No political body outside of eHealth Suisse exists within this policy area; however, this institution is already quite successful as a coordinator. Observed effect: ⊕⊕

Involvement of diverse stakeholders: Thanks particularly to the role of eHealth Suisse, the important stakeholders in Switzerland are strongly integrated, which has a positive effect. Observed effect: ⊕

Commitment and involvement: Because Switzerland's political leadership primarily consists in getting out of the way, so to speak, no effect can be observed here. Observed effect: ⓪

Coordination: Due to the lack of proactive political activity, no effect can be ascertained. Observed effect: ⊖

The information provided here has once again been graphically translated into a diagram (see figure 53). This presents the observations made here in the form of very negative (dark orange) to very positive (dark green) bars. The graphic below describes the individual indicators' above-described expected effects on the state of digitalization. In the following, individual variables and their impact on digitalization will be highlighted and examined in greater detail.

Small country, high political barriers

An interesting picture emerges in Switzerland: On the one hand, one might assume that the country's small size would produce favorable conditions for digitalization, while on the other, the country's pronounced regionalism and federal system might be seen as working in the opposite direction. Because the cantons tend to be strongly guided by their individual interests, pork-barrel policies and isolated projects are common. With the introduction of the OKP, decentralized digital information-exchange projects have emerged in various regions, usually attached to one hospital within a canton. eHealth initiatives are always developed on a regional basis, with levels of progress accordingly quite different.

At the same time, these projects could not move forward without the support of the cantons. Thus, within Switzerland as a whole, there is a variety of constellations of initial conditions, depending on the degree of political support within a given canton. Some individual cantons, such as those in French-speaking Switzerland, are farther along in the process than others, depending on their own roles and governmental leanings. Larger cantons such as St. Gallen have played a pioneering role in eastern Switzerland. Here, for example, the St. Gallen cantonal hospital was crucial in driving digitalization forward. Physicians trained there have in some cases brought their experiences and approaches elsewhere in the region. The canton's political forces have responded to St. Gallen's initiatives by creating a budget for IT support, even though the system there was university-driven. In this regard, St. Gallen is viewed as a prototype for IT development of this kind. At the same time, this kind of isolated project shows that the reputation of the Geneva University Hospital, for example, is better known in Brussels than in eastern Switzerland.[369]

The regulation of each project also takes place on the cantonal level. Basel, for example, is considered to be very progressive, with telemedicine services already in operation; by contrast, Zurich is quite conservative, and is reluctant to construct even so much as a telemedicine triage function. The cantons' broad powers also produce situations in which they and the federal government fall into stand-offs for long, unproductive periods of time, as neither side wants to give up existing competences. Lessons learned on a cross-cantonal basis emerge only occasionally, for example in the case of suicide prevention and the gradual construction of a national cancer registry. All in all, the regional character of policymaking acts as an inhibitory variable.[370]

For the introduction of a national EHR system, this regionalism and federalism were initially hindrances. However, the federal government lacks the appropriate competences to engage in nationally valid legislative projects. Ultimately, proponents' introduction of the EPD law was to a certain extent underhanded, as they were seeking to enact federal legislation despite the lack of a corresponding constitutional basis. At the same time, the cantons wanted a federal-level law; but one whose allocation of competences would leave execution to the cantons. The small cantons lack sufficient staff; thus, they are quite happy with the coordination that has resulted from the EPDG approach.[371] The final EPDG is also regarded as a relatively lean piece of legislation, which is regarded by many as an advantage. However, it also means that the individual cantons must adapt and pass their own cantonal laws. The implementation of the EPDG is thus also being carried out via an implementation ordinance in which much can be regulated in detail.

Regions as a potential advantage

Switzerland's regional character can also be regarded as a positive variable, however. On the one hand, large-scale projects in Switzerland have generally failed, and forcing the national provision of a certain software would almost certainly have been the equivalent of a political suicide run; on the other, well-functioning projects can lead to scaling-up campaigns and adoption in other regions. For example, programs caring for drug-addicted individuals were first tested in individual cities, and then rolled out on a national basis.[372]

In addition, Switzerland's regional character has a positive impact with regard to data protection, in the sense that data is not centrally stored at a single location, among other factors. Swiss citizens have considerable anxiety about the misuse of their data. The solution

369 Ibid.
370 Ibid.
371 Ibid.
372 Ibid.

currently being implemented, to offer the EPD system through the eHealth communities, prevents insurers from deriving advantages from their access to the system. One key element of the health-insurance model is confidence in physicians' actions. In Switzerland, patients generally put trust only in medical professionals to decide on the necessity of a therapeutic or nursing treatment. Regions can also combine efforts in the creation of EPD eHealth communities, and thus save on costs. From the patient point of view, however, there is always a unified system.

Physicians vs. hospitals, interest groups

With regard to actor constellations, the Swiss Medical Association (FMH) in particular plays a strong veto role. Indeed, the outpatient coverage area was initially excluded from the EPD system because the FMH threated to bring a referendum that could have blocked implementation of the entire EPDG. This threat was in part driven by physicians' recognition that they would fundamentally have to give up their information monopoly, which they were reluctant to do. However, because not all physicians are against it – indeed, in Geneva, as many as 700 outpatient physicians want to connect to the EPD system (because they value the access to the hospital files) – patients in Geneva and elsewhere increasingly expect that doctors will use their EPD. Patient organizations also participated in the formulation of the EPDG at a fundamental level. The overall population's attitude toward the project is basically favorable, if not vociferously so. The degree of decentralization makes wide-scale resistance unlikely.[373]

It can be assumed that political pressure on the medical profession will also grow substantially in the future, as the eHealth communities become active. Even today, all eHealth communities are trying to sign up outpatient physicians. The growing tendency toward opening group practices is a benefit for the EPD, as these group practices have a particular need for digitalization within their own organizations. In addition, physicians retain a central role with regard to communication with patients, as the EPD is built on an opt-in model. However, the actual degree of uptake will be evident only after its introduction.[374]

The importance of a digital-health strategy

The particular importance of the first and second *eHealth strategies* has already been described. In this regard, it should again be noted that especially in a fragmented system like Switzerland's, these strategies have played and continue to play an important role. On the one hand, the Federal Office of Public Health initially asked whether the EPD program should be integrated into a larger digitalization strategy; on the other, there were valid concerns about getting lost in the many complicated details of big data, health analytics, etc. While the current strategy for the federal and cantonal levels has been criticized from some corners as being too detailed, it is initially limited to no more than five years, and to the implementation of the EPD system. Thus, the EPD system itself offers the opportunity to strengthen digital cooperation, and can be expanded at a later date with the help of new strategies.

As previously noted, the county's first eHealth Strategy served as an orienting framework for the development of the EPD program, while the Strategy 2.0 is today guiding the program's actual introduction. Early, open discussions and public-opinion campaigns are

373 Ibid.
374 Ibid.

important in order to facilitate a final agreement on common principles and goals that will not be later called into question. At the same time, actors in Switzerland were realistic enough to worry that they would fully exhaust their available resources simply with the focus on the EPD program.

The EPD law as passed thus represents the manifestation of the strategy, as well as the unification of existing approaches under one regulatory framework. Thanks to the law, the country's residents and interest groups now have the opportunity to put political pressure on the participating stakeholders. Interoperability is difficult to achieve without a certain amount of pressure, since proprietary solutions are always simpler from the provider's perspective.

Technical aspects and the IT industry

To an extent, the successful introduction of the national EPD system is attributable both to the role of the IT industry as a driving force, and to a certain amount of deference paid to the industry's views. The creation of eHealth Suisse was partially due to market trends and the urging of the industry. The EPDG also increased the intensity of efforts at the national level as interest in the developing market grew.

At the same time, the law's technical provisions of the law have had a major influence on the EPDG's implementing provisions. For example, very detailed certification standards were developed, which now must be observed. The provisions relating to technical and semantic interoperability and data protection are quite strict, and there are clear provisions regarding patient information.

eHealth communities must undergo a tiered certification process that includes both organizational and technical aspects. With the help of EPD "projectathons" carried out by eHealth Suisse, all interested persons and organizations can test their IT systems in connection with others, and against the EPD reference environment. This enables them to prepare themselves for the practical steps involved in deploying and using the electronic patient dossier, primarily with regard to EPDG certification.

Lack of political leadership

> "Switzerland lacks a coordinated data-exchange system. There is no repository where all health-related information can be archived. The EPD is this location. The information from physicians, hospitals and pharmacies that is relevant to healthcare and to a given course of treatment will be placed there. The EPD is a decentralized implementation guided by a national specification, the EPDG. This law defines the required degree of interoperability, as well as the rights to be accorded to the patient."[375]

Given the above considerations, the role of political leadership in Switzerland is ultimately difficult to judge. On the one hand, the introduction of the EPD law represents a positive political act; on the other, the EPDG's success has rather less to do with active political leadership. Generally, much in Switzerland is left to the cantons, and much with regard to whether implementation takes place in that canton or not depends on the person of the

375 Ibid.

health minister, the party-political configuration, local interest groups, etc.[376] The establishment of eHealth Suisse as a coordinator, and particularly the previously highlighted development of the eHealth strategies, is thus all the more surprising.

The importance of such a strategy for the actual state of digitalization within a healthcare system can be illustrated with the example of the Netherlands. This country performs better than Switzerland in the Digital Health Index, but was set back years by the short-term rejection of its corresponding digital-health (framework) law.

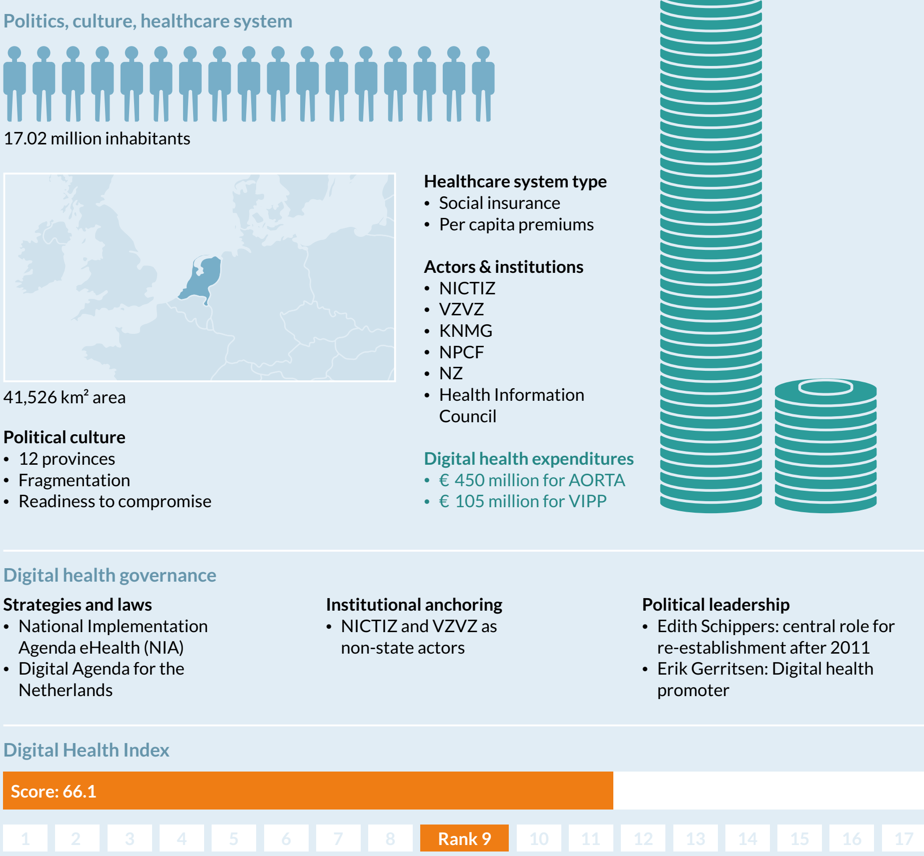
376 Ibid.

6.2 Netherlands

6.2.1 State of digitalization

The actual state of digitalization of the healthcare system in the Netherlands has remained almost unchanged since 2011 as regards the legal framework and is, for the most part, characterized by developments before this time as well as subsequent political events. The electronic patient file (Elektronisch Patiënten Dossier, EPD) was launched in 2008 via an information campaign targeting households nationwide. Citizens were informed by letter of the advantages and disadvantages, as well as of the possibility of opting out of the use of their data. This procedure was intended to be retroactively legally legitimated (2009) by two legislative texts on the EPD introduced by the House of Representatives: the Act on the Use of the Citizen Service Number in Healthcare (Wet gebruik burgerservicenummer in de zorg, Wbsn-z) as well as the amendment of the Act on the Use of a Citizen Service Number in Healthcare in the context of the Exchange of Information in Healthcare *(Regeling gebruik burgerservicenummer in de zorg)*.[377] This process was halted by the Senate in 2010[378]

FIGURE 54: **Netherlands country profile**



Source: Bertelsmann Stiftung

377 Time.lex & Milieu Ltd. (2014). Overview of the national laws on electronic health records in the EU Member States. National Report for the Netherlands. Brussels.

378 nrc.nl, (2010). *Senaat eist stop aanleg medische dossiers.* [online] Available at: https://www.nrc.nl/nieuws/2010/06/02/senaat-eist-stop-aanleg-medische-dossiers-11897632-a1045324

and definitively rejected in 2011.[379] Since then, little has changed with regard to the state of digitalization in the Netherlands.

The Dutch EPD as provided for in the draft legislation comprises a range of applications linked to the national AORTA[380] infrastructure. AORTA is the Dutch infrastructure for the exchange of data between healthcare providers and was developed by the National IT Institute for Healthcare (NICTIZ) under a government mandate. This infrastructure offers a national registration system for identification and authentication, as well as a reference index system known as the National Switch Point (NSP). In place of the planned centralized strategy, the AORTA was regionalized with the aim of improving security and data protection. The NSP was designed as an intermediary "brokering system" for safeguarding access to the respective documents.

The electronic medication record and a patient summary for outpatient physicians were selected as the first chapters for the electronic health record (EHR). The "Patient Summary Record for the Locum GP" dossier *(Waarneem Dossier Huisartsen, WDH)* was developed in 2006 and approved as a proof of concept. This comprises a set of basic information based on the local practice-based health record that is maintained by general practitioners and is implicitly considered to be the patient summary for the entire healthcare system. Until the end of 2009, many local or regional general practitioner organizations used the WDH to exchange data between the general practitioner and medical emergency services (evenings, nights and weekends). Very few of these also use the WDH for national information exchange. As regards this rather pragmatic approach, there are no formal agreements with any of the other service providers and in particular not with patients. Ultimately, the patient decides which physicians are permitted to view which information from their medical record. The local health record from which the WDH is derived consists of the complete list of medical episodes, the notes from the previous five consultations (if there have been more consultations in the previous four months, all the notes sent within that period), the medications (current medication and medication history from the last four months), all medical incompatibilities and the most recent data transfer from other service providers.[381]

The NSP has been in place since 2006 and is comparable to a traffic control tower inasmuch as it regulates the exchange of patient data between service providers. Authorized service providers can view this data to gain a clear picture of a patient's medical history or medication use.[382] The NSP constitutes a reference index for routing, identification, authentication, authorization and logging. Indexing of health records is carried out on the basis of a unique identifier for patients (citizen service number (BSN), the former Dutch social security number) and an information type. Access control in the NSP takes place at a central level based on the authorization granted to the institution of the respective healthcare professional for a certain information category (e. g., clinical or pharmacy record).

Access to the NSP was redesigned following the Senate decision of 2011. Since then, the NSP has been regionally structured and new, artificial boundaries have been incorporated into the system to prevent national data exchange. General practitioners, pharmacies, hospitals and patients are still connected to the system as before, although access is now restricted by region. As a consequence, a move to a different region also entails the loss of all previ-

379 liberties.eu, (2015). *Dutch Senate Skeptical of Electronic Health Records.* [online] Available at: https://www.liberties.eu/en/news/the-netherlands-electronic-health-records/3809
380 Spronk, R (2008). *AORTA, the Dutch national infrastructure,* Haarlem, The Netherlands.
381 empirica (2010). *Country brief: Netherlands. eHealth Strategies.* empirica, European Commission, Bonn / Brussels.
382 Ministry of Health, Welfare and Sport (2006). *ICT in Dutch Healthcare An International Perspective,* The Hague.

ously collected data. This peculiarity is attributable to the Senate decision, and as a consequence there is no involvement on the side of the government.[383]

Instead, in 2012 the private regional relaunch was initiated under the supervision of the Minister of Health and the Association of Care Providers for Care Communication *(Vereniging van Zorgaanbieders voor Zorgcommunicatie, VZVZ),* the development of which was financed by the umbrella organization of Dutch health insurers[384] *(Zorgverzekeraars Nederland, ZN)* toward the exchange of patient data in the form of a medical health record. Patients must explicitly opt in to the new system, both in practices and pharmacies. The implementation of the system was initially slow, although public acceptance has grown in intervening years. From an initial 2.3 million registrations in 2014, data from 11.4 million people were already exchanged in the Netherlands in 2017.[385] Healthcare service providers can decide for themselves whether to connect their health information systems to the NSP or not. At the end of 2016, around 92 percent of healthcare service providers (general practitioners, medical practices, pharmacies and hospitals) were connected over the NSP. As such, within a little over two years, the system encompassed nearly 11 million Dutch citizens and some 150,000 messages were being exchanged on a daily basis.[386] This high percentage is largely explained by the subsidies from health insurance funds allocated to general practitioners and pharmacies to assist in the connection process.[387] Hospitals, which can also exchange information on a supra-regional basis, represent an exception to the regionality obligation.

The so-called BIG-register *(Beroepen in de Individuale Gezondheidszorg Register)* identifies physicians, nurses and paramedics (e. g., physiotherapists), totaling more than 390,000. This BIG-ID for professionals is used as unique identification for the national register: the Dutch Unique Healthcare Provider Identification Register (UZI-register). The BIG-register and the UZI-register are maintained by the Central Information Unit on Health Care Professions *(Centraal Informatiepunt Beroepen Gezondheidszorg, CIBG),* an implementing body of the Ministry of Health, Welfare and Sport. The CIBG provides healthcare service providers with an electronic identity in form of an UZI-card. The CIBG implements public policy, in particular in the area of healthcare provision. Examples include: The CIBG registers service providers in the BIG-register and organ donors in the donor register. Also, in the care sector, the CIBG safeguards the secure digital exchange of data through the use of the UZI-card.

The system for the electronic prescription of medication is in the pilot phase since October 2016, with the first tests completed successfully. Specialists at hospitals can send a prescription via the national AORTA infrastructure or NSP to a pharmacy where the medication will be ready for collection by the patient. It is currently still necessary for the patient to bring a prescription that is signed by the physician, although plans to avoid this duplication in the future are already being formulated. While joint guidelines on electronic prescriptions have been in place since 2013, the pilot trial required a further three years to be implemented in practice. The fact that many patients are not aware of these functions but must nevertheless provide active consent to an exchange of information represents one barrier to actual implementation. Accordingly, NICTIZ is looking to launch

383 liberties.eu, (2015). *Dutch Senate Skeptical of Electronic Health Records.* [online] Available at: https://www.liberties.eu/en/news/the-netherlands-electronic-health-records/3809
384 JASEHN (2017). EU state of play on patient access on eHealth data. Vienna.
385 vzvz.nl, (2018). *VZVZ en het LSP.* [online] Available at: https://www.vzvz.nl/page/Zorgconsument/Links/Over-VZVZ/10-feiten-over-het-LSP
386 computable.nl, (2018). *Hoe staat het met het LSP?.* [online] Available at: https://www.computable.nl/artikel/achtergrond/magazine/5840508/5215853/hoe-staat-het-met-het-lsp.html
387 Eijpe, L. Time.lex & Milieu Ltd. (2014). Overview of the national laws on electronic health records in the EU Member States. *National Report for the Netherlands.* Brussels.

information campaigns aimed at better informing patients and physicians about the opportunities and benefits.[388]

MedMij

A current strategy for counteracting the period of stagnation in the development of digital health systems in the Netherlands since the Senate vote is MedMij, which is still under development. The objective of MedMij is the seamless exchange of medical information via an infrastructure comparable to that used by automated teller machines (ATM). An ATM establishes a connection to a service provider in a global system, enabling the request to be forwarded to the right bank. This service provider is the hub in a network that exchanges all payment information between the bank, the merchant and the customer in a standardized and secure format. MedMij intends to transfer this principle to the healthcare sector, wherein patients will communicate with a physician, pharmacy, hospital or other healthcare service provider through a secure connection with a service provider. As such, MedMij is working to establish a system that will enable every citizen to straightforwardly and securely record, add to and share their healthcare data on a digital basis with other health care providers. The necessary data acquisition takes place, for example, on an app or website.[389, 390, 391]

To this end, applications and websites must be able to communicate securely with all of the systems that store the information. These include, among others, the registration systems at hospitals, general practitioners and municipalities, as well as at fitness centers and pharmacies. MedMij establishes the rules for this secure communication, meaning that all of the information from different locations can be pooled in the same way, and members of the public can view, manage and share their own health information anywhere, anytime and in the manner that suits their needs.

MedMij was selected as an initiative to explore how to make the best use of existing facilities or infrastructures for information exchange in healthcare. Among other aspects, it is examining whether the NSP can continue to be used for the provision of personal health data. Thus far, it cannot be assumed that this will be possible, as the technical vision that MedMij has developed to date is not based on key national strategic decisions such as the NSP. The construction of a prototype is intended to address these issues. However, MedMij does not develop any software, apps or web services itself, which is why the experiments in the testing environment currently under construction comprise only an “intermediate station” that operates according to MedMij rules.

MedMij is an alliance of insurance companies, the government, NICTIZ, umbrella organizations for healthcare providers and the leadership of the Dutch Patients’ Association. Software development for the prototype MedMij software environment is the responsibility of VECOZO, the organization that has functioned for many years as the national communications office for healthcare service providers and health insurers. The standards for MedMij and other consulting functions are developed and rendered by NICTIZ.

388 Interview, study trip to the Netherlands.
389 smarthealth.nl, (2017). *Verzekeraars willen MedMij-programma in praktijk gaan uitproberen.* [online] Available at: https://www.smarthealth.nl/2017/11/02/verzekeraars-medmij-proves-proof-of-concept/
390 medmij.nl, (o.J.). *Waarom MedMij?.* [online] Available at: https://www.medmij.nl/waarom-medmij-zorggebruikers/
391 smarthealth.nl, (2016). MedMij zet eerste stap naar open persoonlijke zorgapps. [online] Available at: https://www.smarthealth.nl/2016/12/22/medmij-zet-eerste-stap-naar-open-persoonlijke-zorgapps/

6.2.2 Structures and characteristics

Country characteristics

The Netherlands is one of four autonomous countries of the Kingdom of the Netherlands.[392] In the Netherlands, 17.02 million inhabitants live on 41.526 km², divided across 12 provinces with 388 municipalities. The system of government corresponds to a constitutional monarchy, while the form of government is a parliamentary democracy. The government of the Netherlands is composed of the king and the ministers. The king functions as a permanent branch of the government and formally as the head of the government. The ministers form the non-permanent part of the government; they are appointed and dismissed by the king. The cabinet consists of the Council of Ministers, without a king.

The absence of any significant electoral thresholds in the Netherlands has traditionally led to high levels of parliamentary fragmentation and problematic government formation processes. Consensus-oriented cooperation with ideological opponents is necessary, as the Netherlands is home to many minority communities and numerous social and ideological groups. As a result, establishing compromises is not seen as negative but smart and pragmatic.[393]

The Netherlands is managed as a decentralized individual state. In practice, this means that the state's central institutions cede specific tasks and responsibilities to subordinate levels (provinces and municipalities). The regional authorities of the provinces and municipalities also have the right of self-government, but only in those areas of responsibility allocated to them by law. The responsibilities of the provinces include regional planning, water and the environment, social welfare and culture, as well as oversight of municipal budgets. As regards healthcare provision, this means that the planning and supervision of nursing homes and long-term care in the Netherlands is the responsibility of the provinces. In turn, the municipalities are responsible for the local health departments.[394]

TABLE 37: **Networked Readiness Index 2016**

	2015 Rank		2016 Rank
Netherlands	4	↓	**6**
Switzerland	6	↓	7
Denmark	15	↑	11
Germany	13	↓	15
Israel	21	→	21
France	26	↑	24

Source: Baller, S., Dutta, S. und Lanvin, B. (2016). The Global Information Technology Report 2016 – Innovating in the Digital Economy. World Economic Forum, Genf.

392 The Dutch EPD as provided for in the draft legislation comprises a range of applications linked to the national AORTA infrastructure. In addition to the Netherlands, these are the overseas territories of Aruba, Curaçao and Sint Maarten.
393 Krause, A. (2017). *Die Niederlande sind ein Land von Minderheiten.* [online] Tagesspiegel. Available at: https://causa.tagesspiegel.de/politik/wie-gefaehrlich-ist-der-niederlaendische-populismus/die-niederlande-sind-ein-land-von-minderheiten.html
394 Bappert, J., Borck, M., Tigges, J. (2006). *Verwaltungsstrukturen in den Niederlanden.* WWU Münster. [online] Available at: https://www.uni-muenster.de/NiederlandeNet/nl-wissen/politik/vertiefung/verwaltungsstrukturen/rijk.html

The Netherlands is ranked sixth on the Networked Readiness Index (NRI), the best result of the five countries surveyed for this study. This result suggests that the political and technical foundations in the Netherlands for exploiting emerging ICT and capitalizing on the opportunities presented by the digital transformation are good to very good. From the observations on the digital health environment, it is not possible to confirm this conclusion for the healthcare sector.

Political culture

Compromise and coordination between many numerous political groups are considered necessary and positive. On the other hand, fragmentation is also a frequent hurdle. New societal or political currents are swiftly represented in the national parliament, channeling unease.[395] In the context of the digital health environment, dissatisfaction was expressed in particular through health advocacy groups – the original EPD law mandated the obligation for all providers to connect to AORTA. At the same time, it was intended to introduce an opt-out provision, which was contrary to other legislation on data protection. Because political parties in the Netherlands generally do not like to be dictated to, this ignited a debate in the Senate that led to the defeat of the EPD law.

However, it should be noted that the debate surrounding data protection is seen by some participants as merely a pretext, and the actual drivers of the defeat were medical associations and other interest groups. As table 38 shows, the population in general has a high level of trust in the data protection maintained by medical and healthcare sector institutions.

TABLE 38: **Trust in medical and healthcare-sector institutions – Netherlands**

	Total "Trust"	Total "Do not trust"
EU-28	74%	24%
Denmark	89%	10%
Germany	77%	21%
France	79%	17%
Netherlands	**81%**	**18%**

Source: TNS Opinion & Social, DG JUST und DG COMM (2015). Special Eurobarometer 431 – Data Protection. European Commission, Brüssel.

Healthcare system type

Until the healthcare reforms of 2006, the healthcare system in the Netherlands was viewed as a hybrid system, consisting of social security alongside a fixed role for private insurers for higher earners. The current healthcare system in the Netherlands' makes use of per capita premiums. Since the health reforms, there is only one health insurance market with compulsory health insurance for all citizens, where previously there had been a division between social and private insurance. The current system, in which it is possible to freely choose between the formerly statutory and private funds as well as to switch from one to the other every year, is based on regulated competition.[396]

395 Krause, A. (2017). *Die Niederlande sind ein Land von Minderheiten.* [online] Tagesspiegel. Available at: https://causa.tagesspiegel.de/politik/wie-gefaehrlich-ist-der-niederlaendische-populismus/die-niederlande-sind-ein-land-von-minderheiten.html
396 Ibid.

Since the reforms, all Dutch citizens are obligated to take out basic insurance, whereby the level of service is the same for all insurers. At the same time, there is a contracting obligation for insurance companies to include citizens in their basic insurance. All health insurance funds are organized in a similar manner under private law and all are subject to state regulation and supervision. The number of health insurance funds has fallen significantly since the reforms. The largest four providers now insure 91 percent of the population.[397]

One half of the health insurance is financed by means of a flat-rate premium that is identical within an insurance plan, regardless of income (age, gender or disease risk do not play a role) but can nevertheless vary between insurance companies. The other half is financed by the employer through income-determined contributions. The health costs for children and adolescents are borne by the government via public funds. The lower the income of a low-earning individual, the higher the tax-funded health insurance fund subsidy granted by the tax authorities.[398]

Healthcare, including prevention, screening and vaccinations, is primarily the responsibility of the municipalities. The larger part of outpatient care in the Netherlands is overseen by the general practitioner system. Patients must choose a physician who functions as a gatekeeper and is typically in a private practice. This gatekeeper principle is a distinguishing feature of the Dutch healthcare system. Outpatient specialist care takes place in the hospitals, which are for the most part non-commercial and managed by private trusts.[399, 400]

Digital health expenditures

It is not possible to determine a unitary budget for digital health systems in the Netherlands. In principle, there are budgets for many of the involved institutions and authorities, but they do not specifically identify spending on digital health systems. It is known that AORTA entailed development costs of around 450 million euros. Furthermore, costs for the VIPP program *(Versnellingsprogramma informatie-uitwisseling patiënt en professional, "Accelerator program for information exchange between patients and specialists")* for streamlining the exchange of information between patients and health professionals have come to around 105 million euros.[401, 402]

Actors and institutions

Two supervisory authorities are responsible for data handling in electronic documents and information exchange between EHRs: The Personal Data Protection Axuthority (Autoriteit Persoonsgegevens, AP) is responsible for enforcing data protection rules, while the Health Care Inspectorate *(Inspection voor de Gezondheidszorg, IGZ)* first and foremost enforces quality standards for healthcare provision. NICTIZ is mandated with numerous duties by the Ministry of Health, Welfare and Sport: It develops and coordinates the strategic introduction and development of the ICT infrastructure in the healthcare sector and for the areas of technical standards and protocols and oversees the maintenance of the national

397 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.
398 Ibid.
399 Ibid.
400 Kroneman, M. Boerma, W. van den Berg, M. Groenewegen, P. de Jong, J. van Ginneken, E. (2016). The Netherlands: health system review. *Health Systems in Transition,* 18(2), pp. 1–239.
401 Interview, study trip to the Netherlands.
402 nvz-ziekenhuizen.nl, (o.J.). *VIPP-programma.* [online] Available at: https://www.nvz-ziekenhuizen.nl/onderwerpen/vipp-programma

infrastructure and its management. At its highest level, the Ministry of Health, Welfare and Sport is responsible for legislation, policy and budgets in healthcare.

The government tracks the progress of digital developments in healthcare and assesses whether its objectives are being fulfilled. It also commissions an annual survey on the numbers of people using digital health services.

The AP[403, 404]oversees compliance with legal guidelines in the area of digital health systems.[405, 406] Reports from 2013 and 2014 indicate insufficient protection of private patient data at the competent VZVZ.

The VZVZ was founded in 2012 by the Dutch Association of Family Physicians (LHV) as well as the umbrella organizations for primary care providers (InEen), pharmacies (KNMP) and hospitals (NVZ), and since that time has overseen the exchange of data on the NSP and is working to improve and further develop the AORTA infrastructure.

The Dutch Ministry of Health, Welfare and Sport *(van Volksgezondheid, Welzijn en Sport, VWS)* has been working with various healthcare actors to establish a nationwide system for the secure and reliable electronic exchange of medical data between service providers.

The 2014-founded Health Information Council *(Informatieberaad Zorg)* is an administrative coordination body between the VWS and participants from the care sector. Among others, the Council coordinates the Dutch Royal Medical Association *(Koninklijke Nederlandse Maatschappij tot bevordering van de Geneeskunst, KNMG)*, the Netherlands Patients' Association *(Nederlandse Patiënten Consumenten Federatie, NPCF)*, the Patients' Federation Netherlands (Patiëntenfederatie Nederland), the Association of Dutch Health Insurers *(Zorgverzekeraars Nederland, ZN)*, the Dutch Hospital Association *(Nederlandse Vereniging van Ziekenhuizen, NVZ)* and the Dutch Association of Family Physicians *(Landelijke Huisartsen Vereniging, LHV)*.
The council is chaired by the General Secretary of the VWS.[407]

VECOZO has evolved to become the national hub for secure digital communication in healthcare. In principle, the organization functions as a portal for digital messaging in healthcare, with the objective of cost control through the reduction of administrative burdens. Its position as a hub for digital messaging makes it an important partner for all digital administration processes.[408]

403 autoriteitpersoonsgegevens.nl, (o.J.). *Mission vision and core values.* [online] Available at: https://autoriteitpersoonsgegevens.nl/en/about-cbp/mission-vission-and-core-values
404 Until 1 January 2016 College bescherming persoonsgegevens (CBP), Engl.: Data protection authorities
405 College bescherming persoonsgegeven (now: Autoriteit Persoonsgegevens) (2014): Onderzoek naar de toestemming voor de uitwisseling van medische persoonsgegevens via het Landelijk Schakelpunt.
406 College bescherming persoonsgegeven (now: Autoriteit Persoonsgegevens) (2013): Toegang tot digitale patiëntendossiers binnen zorginstellingen.
407 informatieberaadzorg.nl, (o.J.). *Deelnemers.* [online] Available at: https://www.informatieberaadzorg.nl/over-het-informatieberaad/deelnemers
408 vecozo.n,.(o.J.). *Wie zijn wij.* [online] Available at: https://www.vecozo.nl/over-ons/Wie-zijn-wij/

6.2.3 Digital health governance

Strategies and laws

Because the area of digital health is considered part of the regular healthcare system, there are no specific digital health laws in the Netherlands, nor is there a stand-alone digital health strategy. The current strategy in the regular health care system is described as "backend to frontend." Namely, it is intended to provide a basis for the public to independently and actively manage their own health, with digital health systems serving as one part of this strategy. Three objectives have been defined to this end:[409, 410]

1. By 2019, at least 80 percent of the chronically ill should have electronic access to their own clinical records, alongside at least 40 percent of the rest of the population.
2. By 2019, 75 percent of the chronically ill and at-risk elderly should be able to monitor certain aspects of their own health and share the data with their healthcare provider (self-test and self-management). This would include values such as blood pressure and cholesterol level.
3. People requiring care at home should be able to communicate with their caregiver 24 hours a day via a screen, if they so desire (support through telemedicine and online diagnosis).

The individual objectives can be found, among others, in the National Digital Agenda,[411] the Medical Treatment Act,[412] the Personal Data Protection Act,[413] the NICTIZ agenda for ICT in healthcare, and the National Implementation Agenda eHealth NIA that is being pursued by the KNMG, NPCF and NZ.[414] In addition, the following documents are relevant to the field of digital health systems: The Vision Inspiration for Innovation from the Healthcare Innovation Platform *(Zorginnovatieplatform, ZIP)*[415] as well as the KNMG guidelines for the handling of medical data.[416] The vision articulated by ZIP is oriented toward chronically ill and elderly people. One of the three main aspects is the ongoing development of the opportunities presented by ICT, and thus the development of digital health applications and labor-saving technologies is mentioned explicitly. The KNMG guidelines cover the handling of medical data, including a standpoint on the EHR and the use of the citizen service number in care.

409 HMSS Europe (2016). Interview with Bas Van den Dungen, Director General of Curative Care at the Dutch Ministry of Health. [video]. Available at: https://www.youtube.com/watch?v=i8qzZQplfIA
410 government.nl, (2015). *Government encouraging use of eHealth.* [online] Available at: https://www.government.nl/topics/ehealth/government-encouraging-use-of-ehealth
411 Ministry of Economic Affairs (2016). *Digital Agenda for the Netherlands – Innovation, Trust, Accelaration.* [pdf] Available at: https://www.government.nl/binaries/government/documents/reports/2017/04/11/digital-agenda-for-the-netherlands-innovation-trust-acceleration/Digitale+Agenda+ENGELSE+VERSIE.pdf
412 Interview, study trip to the Netherlands.
413 Ibid.
414 NPCF, KNMG, ZN (2012). *Nationale Implementatieagenda e-health (nia).* [pdf] Available at: https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2012/06/07/nationale-implementatieagenda-e-health-nia/nationale-implementatieagenda-e-health-nia.pdf
415 Zorginnovatieplatform (2009). Inspiratie voor innovatie, De visie van het Zorginnovatieplatform. Den Haag.
416 Royal Dutch Medical Association (2010) *Richtlijnen inzake het omgaan met medische gegevens,* Utrecht, (Guideline on processing of medical data), [pdf] Available at: https://www.nvpc.nl/uploads/stand/64Richtlijnen_Omgaan_met_medische_gegevens.pdf

TABLE 39: **Netherlands' digital health timeline**

Year	Strategy / draft law
1994	*Wet geneeskundige behandelingsovereenkomst (WGBO)* – Medical Treatment Contracts Act
2001	*Wet bescherming persoonsgegevens (WBP)* – Personal Data Protection Act
2007	*Geneesmiddelenwet (Gmw)* – Medicines Act
2008	*Wet gebruik burgerservicenummer in de zorg (Wgbsn-z)* – Act on the use of a citizen service number in healthcare
2008	*Regeling gebruik burgerservicenummer in de zorg* – Provision on the use of a citizen service number in healthcare
2008	*Wet publieke gezondheid* – Health law
2012	*National Implementation Agenda e-health (NIA)* – National Implementation Agenda eHealth
2013	*Besluit electronic gegevensuitwisseling tussen zorgaanbieders* – Decision on electronic data exchange between service providers
2016	National Digital Agenda for the Netherlands
2016	*Versnellingsprogramma informatie-uitwisseling patiënt en professional (VIPP)* – Accelerator program for information exchange between patients and specialists

Source: Bertelsmann Stiftung

The NVZ, together with the Ministry, founded the VIPP in 2016. The program runs until the end of 2019 and comprises a two-pronged strategy:

1. Data exchange with the patient and
2. data exchange between professionals and with the patient on the topic of medications.

The following goals were formulated:[417]

- On 1 July 2018, healthcare institutions may offer patients at least one download of medical data;
- On 31 December 2019, every healthcare facility will maintain a secure patient portal and / or a connection to a personal health environment into which the healthcare facility can upload standardized medical data relating to the patient;
- From 1 July 2018, all medical institutions will be able to view a digital and up-to-date summary of medications (dispensing information) as part of the clinical and outpatient medication process;
- As of 31 December 2019, every healthcare facility can offer medications on a digital basis, for advance notice and / or prescription;
- On 31 December 2019, every healthcare facility can provide newly discharged patients with a digital, standardized and up-to-date list of medications (including medication agreements), in accordance with the current guidelines on medications.

Because VIPP is an implementation program, this program is not tasked with the development of new standards but only of solutions consistent with existing national standards. The VIPP is derived from Vision 2020, the NVZ strategy paper that, among other things, emphasizes the role of information and communication technology.[418]

The recently launched initiative from the Health Information Council for public deliberation on Public Key Infrastructure (PKI) constitutes a further source of momentum. A PKI is an authentication tool designed to facilitate the secure exchange of data. Against a backdrop

417 nvz-ziekenhuizen.nl.(o.J.). *VIPP-programma.* [online] Available at: https://www.nvz-ziekenhuizen.nl/onderwerpen/vipp-programma
418 zorgvoor2020.nl. (o.J.). *Ict zorgt met u mee.* [online] Available at: http://www.zorgvoor2020.nl/hoofdstuk/2/

of a range of different solutions to the problem, an open dialogue was initiated. The immediate reason for the activities of the working group was a question from the MedMij program on the use of the PKI for Personal Health Environments.[419]

Institutional embedding

The assessment of institutional embedding is based on the three indicators of

1. secured financing for national/regional digital health competence centers,
2. centralized political management, and
3. the inclusion of various stakeholders.

It is worthy of note that the two main centers of excellence in the Netherlands, NICTIZ and VZVZ, are not under state control. Although NICTIZ is government-funded, it is ultimately a private non-profit institution in the manner of the VZVZ. After the failure of the original planning, NICTIZ was privatized and remodeled as a knowledge center commissioned with the ongoing development of standards. The entire AORTA and NSP were transferred to the VZVZ with the aim of relinquishing state control. There were no further attempts to establish a national EHR in the years following the failure.[420]

At this time, the institutional embedding in the Netherlands is first and foremost in the Health Information Council, which functions as a coordinating body between the government and various stakeholders in the field of healthcare. At the same time, there is no obligation to join the Council and decisions are non-binding. Increasingly, however, decisions from the Council go on to be implemented in a legally binding form.

Political leadership

Responsibility for health and healthcare lies with the Ministry of Health, Welfare and Sport, which is developing basic measures and laws to improve the health and well-being of the Dutch population. The Ministry of Finance, on the other hand, influences health policy through the Tax and Customs Administration *(Belastingdienst)*. This determines the level of employer contributions to the health insurance system as well as the care allowance *(zorgtoeslag)* paid on behalf of low earners. The Ministry of Social Affairs and Employment *(Ministry of Social Affairs Zaken en Werkgelegenheid, SZW)* is responsible for cases of illness and disability that occur outside of statutory health insurance.

Healthcare policy in the Netherlands is complex and difficult to accurately predict. There are many involved actors, and although ultimate political responsibility for the healthcare sector lies with the government, there is little scope for action. The traditional self-regulation as well as the many private services in the overall healthcare system has given rise to a sector that is dominated by numerous interdependent actors. The consequence of this situation is that while the government continues to play an important role in terms of budget allocations and disease prevention, it is unable to assert its competencies due to the high number of powerful actors.[421]

419 informatieberaadzorg.nl. (2018) *Open consultatie vanaf vandaag live!.* [online] Available at: https://www.informatieberaadzorg.nl/actueel/nieuws/2018/6/19/open-consultatie-vanaf-vandaag-live
420 Interview, study trip to the Netherlands.
421 van der Grinten, T (2006). *Zorgen om beleid. Over blijvende afhankelijkheden en veranderende bestuurlijke verhoudingen in de gezondheidszorg [Worries about policy. About continuing dependencies and changing policy conditions in health care].* Rotterdam: Erasmus University

Political leadership in the area of digital health certainly exists in the Netherlands. The Ministry of Health, Welfare and Sport stands out in particular. A high level of personal activity or even political leadership can be reported – albeit limited to the policy area of health – and there are measures from the Ministry for the promotion of digital issues. Deserving of mention here are former Minister Edith Schippers and the current Secretary-General of the Ministry of Health, Welfare and Sports.

During her time in office (2010-2017), Schippers was a proponent for an open and ambitious strategy as regards the digital health environment. Under her leadership, the *eHealth monitor* was introduced by NICTIZ, and she furthered her own vision of the digital health environment, despite a lack of laws and strategies. As a culmination of these efforts, it is evident that the (digital) health landscape flourished during and after her time. More problematic, on the other hand, was the absence of a coherent model to tie these new efforts together, meaning that aspiring projects were never expanded due to a lack of concrete goals and the resulting scarcity of financing.[422]

Essentially, the Ministry of Health, Welfare and Sport sees itself as a driver of digital health systems. Alongside, it is responsible for the agenda laid out by the Health Information Council. The current Secretary-General thus has a particularly active role in this regard, both as chairman and as a promoter of digital health systems. More recently, the digital health environment has once again found its way into the discussions of the Health Information Council, in particular thanks to steady marketing and social media campaigns.

The Health Information Council plays an important role in the ongoing development of digital health systems. The primary objective is to make effective decisions to which the respective interest groups also abide. While some of the participating associations lack the requisite support from their members, and others are driven by self-interest, there is a general consensus that members are committed to the Health Information Council and that informed decisions are being made. It is apparent that some associations/organizations have resigned from the Council as more binding outcomes that are against their interests have been decided. However, this development can be assessed as positive: On one hand, the voluntary nature of participation leads to a productive relationship; on the other, it aids in the derivation of binding and enforceable decisions for policymaking.[423]

It can be observed that the topics of care, EPD and digital health systems also surface in the viewpoints of the various parties on the subject of healthcare. The winning party in the most recent parliamentary elections, the People's Party for Freedom and Democracy (Volkspartij voor Vrijheid en Democratie, VVD), is vocal in its support of digital health systems, and the Labor Party (Arbeiterpartei Partij van de Arbeid, PvdA) openly supports the EPD system. Digital Health also played an active role in the election campaign.

422 Interview, Studienreise Niederlande
423 Ibid.

6.2.4 Impact analysis

The following section describes the observed influence of different variables on the process of digitalization in the Netherlands.

The following observations were made regarding individual variables:

Country and population size: In the Netherlands, the size of the country and number of inhabitants have no ascertainable effect on digitalization. Although the country is relatively small, there are no specific identifiable advantages or disadvantages. Observed effect: 0

State and government form: The state and government form (constitutional monarchy and parliamentary democracy) has neither a positive nor a negative effect on the state of digitalization. Observed effect: 0

Political order: Centralism vs. federalism and subsidiarity: Organization via a central government with provinces and municipalities has a moderately positive effect on the development of digitalization. However, because there is no federalism, no effect has been determined. Observed effect: 0

Corporatism (degree of self-government): Due to self-government in the Netherlands, this characteristic has a slight negative impact. Observed effect: −

Compromise and consensus: If consensus is achieved, for example in the Health Information Council, then this has a positive impact. Observed expected effect: +

Role and cultural embeddedness of data-privacy protections: An apparent slight discrepancy exists between the need for data protection of citizens (see above) and the political agendas of individual stakeholders. This can be traced back in particular to the failure of the eHealth legislation. Observed effect: − −

Financing system: Social-insurance system (Bismarck) vs. state-run health service (Beveridge) vs. hybrid system: The financing of the Dutch healthcare system functions on the basis of per capita premiums. The overall system is one of regulated competition between insurers with identical levels of service, which does not appear to have a positive or negative impact on digitalization. Observed effect: 0

Regional / municipal vs. national organizational structure: There is a central organization and set of regulations for the entire Netherlands. In accordance with the assumption that the level of digitalization decreases with increasing regionalization, no effect can be determined here. Observed effect: 0

Public expenditure for digital health issues: For a relatively large amount of money, a properly functioning national infrastructure has been created in the Netherlands, upon which it is now possible to build. Observed effect: +

Actor constellations and advocacy coalitions: Because cooperation between at least the KNMG, NPCF and ZN is necessary for the successful scaling-up of relevant eHealth applications in the Netherlands, entailing a concerted effort by at least three large stakeholders, this has a very negative impact on digitalization. Observed effect: − −

Number of strategies and laws: The negative influence of this variable in the Netherlands is evident due to the lack of a digital health strategy with clear visions, goals and frameworks. Instead, there are numerous, scattered digitalization strategies. Observed effect: −

Quality of legislation: Since the failure of the EPD law in the Netherlands, it is not possible to make conclusive statements on quality. Observed effect: 0

Binding application of standards and interoperability solutions: Because the NICTIZ develops a range of standards for applications but there is no institution to enforce these or monitor their

FIGURE 55: **Expected vs. observed effect of influencing variables on the state of digitalization – Netherlands**

Source: Bertelsmann Stiftung

application, it is only possible to observe a slight positive effect. A national communications infrastructure is in place in the form of AORTA. Observed effect: ⊕

Role of digital health strategies: Again, it is clear that there is no firm strategy and thus it is not possible to assess the role that is played. Observed effect: 0

Secured financing for national / regional digital health competence centers: Particularly worthy of emphasis is the positive role of the state-funded NICTIZ. Observed effect: ⊕

Central political management installed: Although the Health Information Council is now in place, there are very few observable effects. Observed effect: 0

Involvement of diverse stakeholders While various stakeholders are involved through the Health Information Council, the IT industry remains outside of the frame. it is not yet possible to determine a positive effect. Observed effect: 0

Commitment and Involvement: eHealth can be identified as a campaign issue in various political parties in the country, and individual politicians are increasingly making the topic a part of their agenda, which is why this variable has a positive effect on digitalization. Observed effect: +

Coordination: At this time, there are very few proactive policies with a corresponding impact. Observed effect: 0

The information provided is again graphically depicted in a chart (see figure 55). This shows the observations made here, in the form of colored bars ranging from very negative (dark orange) to very positive (dark green). The graphic below describes the above-noted individual indicators' expected effects on the state of digitalization. In the following, the individual variables and their channels of impact for digitalization will be highlighted and elucidated.

When politics interferes

The Netherlands could have progressed far further in its digitalization efforts and would likely already have a functioning national EHR if the state had not interfered. Critics contend that there should never have been an attempt to enact an EPD law. The rejection by the Senate in 2011 was understood by participants not as a rejection of the entire infrastructure but as a rejection of interference from the government, in particular following pressure from individual medical experts. Legal proceedings were initiated by physicians against AORTA as late as in 2017.[424]

On one hand, the government of the time was answerable for the severe setback. Alongside, the existing foundations such as AORTA and NSP originally came about thanks to the initiative of the government. The development of the AORTA infrastructure by NICTIZ goes back to the then ministers.[425] Over a period of 15 years, the development from technical interoperability to semantic interoperability has been driven not so much by financial incentives but to a far greater extent by stakeholder interests, research and development.[426]

Saving what can be saved

Because a great deal in relation to the digital health environment in the Netherlands can be traced back to the failed vote, the policy-makers at the time should be given credit for the insight to nevertheless leave the AORTA and NSP infrastructure fundamentally intact. However, for these to continue, it was necessary for the state to withdraw entirely, as well as for the NICTIZ to be privatized and the infrastructure to be largely sold to the insurers (represented by the VZVZ).

By 2011, all exchange of data was referred to as the "electronic health record" (EHR), but after the crucial vote, the term "national EHR" was politically tarnished and the ambitions for a national EHR had to be abandoned. The situation has cooled in the meantime due to the privatization of the infrastructure and a resolute dispensation with further state regulation.

424 Ibid.
425 Ibid.
426 Cornet, R. (2017). Infrastructure and Capacity Building for Semantic Interoperability in Healthcare in the Netherlands. *Building capacity for health informatics in the future*, (234), pp. 70-74.

The factors of privatization and industry

It can be said that the privatization of AORTA has spared the Netherlands from an even greater setback, that infrastructure development is now being driven forward by the VZVZ and that the environment is increasingly viewed as innovative and, as a result, there is more investment in health IT. Against this, it should be stated that many private providers have emerged today in the Netherlands, offering both practice-based systems for physicians as well as EHR systems for hospitals. Because these are mostly proprietary and come with their own standards (e.g., EPIC), the adaptations that are required to meet Dutch standards are expensive for the hospitals (around 1 million euros per adaptation).

A back door to the EHR for big data

One of the reasons behind the reemergence of the EHR on the political map is interest in topics such as big data, advanced analytics and clinical registries. However, the political side was quick to conclude that this would necessitate data and data exchange. Since that time, individual figures such as former Minister Schippers have helped the issues of digital health systems and data exchange to make enormous progress. As a result, a growing digital health community is once again developing in the country. Nevertheless, the process has now arrived at a point where development is beginning to stagnate and policy intervention from some participants is required.

Seeing the forest for the trees – a spate of EHRs

Countless electronic patient systems are already in place in the Netherlands, in the individual medical practices and hospitals. These can in principle be connected to the AORTA, although data exchange has not yet taken place, either because of technical shortcomings or due to a lack of knowledge of data exchange on the side of physicians and patients. Ultimately, the newly organized MedMij is nothing more than a platform aimed at bundling various local systems and joining them together to form a national EHR, only with a different name. To do this, it will be necessary to fulfill the necessary standards. At the same time, the intention is to strengthen the role of patients and to withdraw from the political line of fire, following the experience gained from the failed legislation.

Lack of strategy, leadership, cooperation

One of the problems in the Netherlands is that, despite a good starting position, the existing infrastructure means that progress will invariably be limited. In turn, one of the reasons for this is the multiplicity of actors and the lack of clear alignment. Unlike Switzerland, for example, there is less consensus building among participating actors, despite the fact that the process is mandatory. At the same time, proper intervention from the government is rejected. The motto is: "If something should happen, leave it to the private [self-governing] healthcare sector."[427] Meanwhile, the Ministry of Health is attempting to enforce standards, in particular in the IT sector, and to make these binding for all participants. However, this poses the same potential danger as the original EPD law: Because healthcare professionals do not welcome laws that dictate what they can and cannot do, any solution must serve to bring the different sides together. Accordingly, only a solution that is the result of a common consensus would actually be recognized. Standing in the way of such a consensus is a continuing lack of basic strategy as well as inadequate commitment from political participants and, above all, insufficient will to cooperate on the side of the various healthcare sector actors.

427 Ibid.

6.3 Denmark

6.3.1 State of digitalization

Denmark's healthcare system is one of the world's most advanced in terms of digital health. In particular, the actual exchange of data between healthcare providers takes place by and large electronically. The following Danish Ministry of Health statistics reflect this fact:[428]

- All Danish general practitioners possess an electronic health record (EHR), and 98 percent also exchange records with each other electronically.
- Test results from hospitals are transferred to general practitioners exclusively in digital format.
- Some 99 percent of all prescriptions are sent to pharmacies using electronic means.
- A total of 97 percent of all referrals take place electronically, and all referrals to specialists and psychologists are electronic.

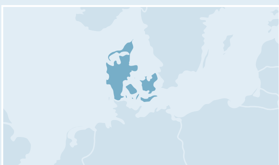
There are many major digital health applications that are widely used in Denmark:

The eJournal is a central database that sources information directly from the EHRs of the hospitals in Denmark's five regions. The eJournal, or eRecord, provides patients and other parties in the healthcare sector digital access to diagnosis information, treatment plans and

FIGURE 56: **Denmark country profile**

Politics, culture, healthcare system

5.78 m inhabitants



43,094 km² area

Political culture
- Compromise and consensus

Type of healthcare system
- Publicly financed health-care system

Stakeholders & institutions
- MedCom
- Sundhed.dk
- Danish Health Authority
- Danish Health Data Authority

Digital health expenditure
- sundhed.dk: €55.6 m
- Danish Health Data Authority: €41.5 m
- MedCom: €1.9 m

Digital health governance

Strategies and laws
- *A coherent and trustworthy health network for all*

Institutional anchoring
- National Board of eHealth as a platform of exchange between the central government, the regions and the municipalities

Political leadership
"Political leadership by the Minister of Health is not desired; success and failure should remain with the regions"

Digital Health Index

Score: 72.5

1 2 Rank 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Source: Bertelsmann Stiftung

428 Ministry of Health (2017). *Digitisation and Health Data. Healthcare in Denmark – An Overview.* Indenrigs- og Sundhedsministeriet, København.

notes directly from the EHR systems of all public hospitals. Around half of all hospitals also have access to medication records and laboratory results.[429]

The eJournal is supplemented by the pJournal, which stores information from the EHRs of outpatient physicians. The pJournal is available to the public, hospitals, and practices on sundhed.dk. The pJournal is clearly more patient-oriented than the eJournal. Physicians can view information on their own patients, as well as for patients of other physicians that they are filling in for, for example, when the patients' usual physician is on holiday. Specialists can view information on patients that are referred to them by other physicians. Hospitals can view information only when they are treating the patient.[430]

In addition to both journals, there is the Shared Medication Record, a central database of the Danish Health Data Authority that has information on the prescription medication of all Danes over two years, as well as their current medication. In contrast to the journals, this can communicate directly with the EHRs of hospitals and general practitioners. It provides information on a patient's current medication and their vaccination status. The Shared Medication Record is available to all healthcare professionals to whom the patient grants access. Physicians are legally obliged to keep this record up-to-date, and also have to ensure that all systems can gain access to this database.

Furthermore, there is the ePrescription: an online service operated by the Danish Medicines Agency. This service allows the electronic transfer and cancellation of prescriptions by the treating physician, and also automatically generates notifications when medication has been dispensed to patients.

The central element of the digital healthcare system in Denmark is the national health information portal sundhed.dk. This represents the interface of all digital health applications. Personalized data are accessed by means of the NemID, an electronic login solution for banks, authorities and other websites. The national patient summary, the Shared Medical Record, has been available on the sundhed.dk portal since 2014.

Although local EHRs have 100 percent coverage in hospitals and with general practitioners, interoperability is still limited: hospitals and general practitioners can exchange data among each other (i.e., from hospital to hospital, or from general practitioner to general practitioner), but rarely between each other (i.e., from general practitioner to hospital and vice-versa). As such, a national EHR with overarching data exchange is not yet fully available.

429 Danish Ministry of Health (2012). *eHealth in Denmark – eHealth as part of a coherent Danish health care system.* Danish Ministry of Health, Copenhagen.

430 medcom.dk. (n.d) *Information om p-journal.* [pdf] Available at: http://medcom.dk/media/4372/p-journalbrochure.pdf.

6.3.2 Structures and characteristics

Country characteristics

The Kingdom of Denmark consists of the islands of Jutland, Funen, Zealand, and around 500 other islands (including Lolland, Falster and Bornholm), as well as the autonomous self-governing constituent countries of Greenland and the Faroe Islands. Some 5.78 million inhabitants are spread throughout Denmark's 43,094 km^2 (excluding Greenland and the Faroe Islands). The form of state and government corresponds to a constitutional monarchy with a parliamentary democratic system of government. Historically, there were more than 1,000 municipalities in 23 administrative districts. Over the course of time, Denmark's administrative structure was changed by many reforms, with the most recent of these, the Municipal Reform of 2007, reducing the number of municipalities to 98. Since 2007, Denmark has officially consisted of five regions.[431] The five regions are governed by the regional councils, which are elected every four years. The councils constitute the interest groups for the individual regions. In Denmark, strategy and policy papers are usually prepared by the Danish government together with the regional councils.

One reason for the structural reforms of 2007 was the increasing difficulties faced by the small municipalities in providing a satisfactory level of quality in many specialized services. The main tasks of the regions are to provide services, especially services related to healthcare, public transport, tourism, education and managing soil pollution.[432] The size of the municipalities played a decisive role in the inadequate quality of healthcare, which was characterized, inter alia, by the fact that small municipalities were often unable to provide sufficient qualified personnel and specialists. As a result of the restructuring and reduction of municipalities and counties, the average number of inhabitants per municipality rose from about 19,000 to circa 55,000. This allowed for higher quality hospitals that could care for a larger part of the population, and ultimately also resulted in a less decentralized regulation of healthcare. In the same year, the Danish government invested € 25 billion in the renovation of existing hospitals and the establishment of new specialized hospitals, and the regional councils and the government published the first strategy for the digitalization of the healthcare system.[433]

TABLE 40: **Networked Readiness Index 2016**

	Rank 2015		Rank 2016
Netherlands	4	↓	6
Switzerland	6	↓	7
Denmark	15	↑	**11**
Germany	13	↓	15
Israel	21	→	21
France	26	↑	24

Source: Bertelsmann Stiftung

431 regioner.dk. (n. d.). *Regional Denmark.* [online] Available at: http://regioner.dk/services/in-english/regional-denmark.

432 Ibid.

433 Christiansen, T. (2012). Ten years of structural reforms in Danish healthcare. *Health Policy*, *106*(2), pp. 114–119. doi:10.1016/j.healthpol.2012.03.019.

Denmark is in eleventh place in the Networked Readiness Index (NRI). This result indicates the existence of good political and technical preconditions in Denmark for taking advantage of emerging ICT and for capitalizing on the opportunities of digital transformation. In comparison to the five other countries examined, this result seems surprisingly weak with respect to digital health, however the NRI also takes into consideration other areas of ICT.

Political culture

The political culture in Denmark is based on compromise and consensus between political actors. As is the case for all of Scandinavia, Danish politics in the twentieth century was characterized by the dominance of social democracy and the development of the welfare state. Denmark's political orientation is very egalitarian in comparison with most other countries. Recent political history has led to a culture with a strong national sentiment and a general need for economic and political equality, as well as for dialogue, pragmatism, compromise and anti-authoritarianism. There is a very critical attitude towards political leaders.[434] Voter turnout is generally high, and the Danish people are well informed about politics. According to opinion polls, 70 percent of voters are very or somewhat interested in politics, and almost 90 percent are largely satisfied with the functioning of democracy.[435] In this context, it is worth mentioning that there is a certain tradition for minority governments.[436]

The Danish data protection regulations provide good access for using health data for research projects or clinical trials, provided they meet the basic requirements of being of "general societal importance." The data have to be handled and used in a secure manner, and the individual's right to privacy is to be respected. The Danish Data Protection Agency oversees that the legal requirements concerning health data are satisfied before data are used in research projects or clinical trials.[437]

In Denmark, there is a generally high level of digital health competency and ability to search, find, understand and evaluate information on health problems using electronic sources.[438] In combination with the attitude towards data protection (see table 41), there

TABLE 41: **Trust in medical institutions and healthcare facilities – Denmark**

	Total "trust"	Total "do not trust"
EU-28	74 %	24 %
Denmark	**89 %**	**10 %**
Germany	77 %	21 %
France	79 %	17 %
Netherlands	81 %	18 %

Source: TNS Opinion & Social, DG JUST und DG COMM (2015). Special Eurobarometer 431 – Data Protection. European Commission, Brüssel.

434 Jensen T.K. (1999) Dänemark: Berufspolitiker in einer egalitären politischen Kultur. Borchert J. (eds) *Politik als Beruf. Reihe Europa- und Nordamerika-Studien,* vol 5.
435 Dänisches Außenministerium (2006). *Dänische Themen. Das Politische System.* Kopenhagen.
436 Olejaz, M. Juul Nielsen, A. Rudkjøbing, A. Okkels Birk, H. Krasnik, A. Hernández-Quevedo, C. (2012). Denmark: Health system review. *Health Systems in Transition,* 14(2):1-192.
437 Ministry of Health (2017). *Digitisation and Health Data. Healthcare in Denmark – An Overview.* Indenrigs- og Sundhedsministeriet, København.
438 Bo et al. (2014): National indicators of health literacy: ability to understand health information and to engage actively with healthcare providers – a population-based survey among Danish adults. *BMC Public Health,* 14, pp. 1095.

is a very advantageous starting position for the process of digitalization in the healthcare sector, which, in summary, can be described as liberal.

Type of healthcare system

In categorizing the Danish healthcare system within the classic typologies of social insurance or national healthcare service, it tends towards the latter category. Healthcare is generally organized through a public service that is available to the entire population. The healthcare system is based on three pillars: the central government (the Ministry of Health), the regions, and the municipalities.[439]

Until the Municipal Reform of 2007, the role of the central government was essentially limited to framework legislation as well as advising and recommending health policy objectives. The actual design and implementation is the responsibility of the regions. They are responsible for providing healthcare services, running the hospitals and other care facilities, and have to ensure the Danish population's access to primary care. [440]

The Municipal Reform of 2007 entailed a centralization of the healthcare system, with financing in particular being reorganized. The right to levy their own taxes was withdrawn from the municipalities, and decisions regarding the construction of hospitals were transferred to the central government. Since 2008, the healthcare system has been financed by an earmarked health tax, whose proceeds are distributed to the municipalities. Around 20 percent of total healthcare expenditure is financed by the municipalities. The objective of these local contributions is to encourage the municipalities to introduce efficient preventative measures in the field of public health, such as information campaigns, to relieve the healthcare system of costs in advance.[441]

Within the Danish Health Authority area of responsibility lie diverse planning activities for the assumption of quality management and the distribution of medical specialties among hospitals. The regions are responsible for hospitals and independent physicians, whereas the activities of the municipalities focus on local disease prevention and health promotion. They can determine the scale, the content and the costs of hospital activities through detailed budgets. These budgets allow them to determine what treatments are offered and which technical devices should be purchased.[442] Almost all hospital beds (97%) are publically owned. Recent trends include the merging and renovation of hospitals and a reorganization of acute care, including the centralization of medical specializations in joint acute wards.[443]

439 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd edition. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

440 regioner.dk, (n.d). *Regional Denmark.* [online] Available at: http://regioner.dk/services/in-english/regional-denmark.

441 Schölkopf, M. and Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd edition. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

442 Olejaz, M. Juul Nielsen, A. Rudkjøbing, A. Okkels Birk, H. Krasnik, A. Hernández-Quevedo, C. (2012). Denmark: Health system review. *Health Systems in Transition,* 14(2):1-192.

443 OECD/European Observatory on Health Systems and Policies (2017), *Denmark: Country Health Profile 2017,* OECD Publishing, Paris/European Observatory on Health Systems and Policies, Brussels.

Digital health expenditures

As with the other countries in the study, it is difficult to quantify the exact expenditure on digital health in Denmark . As there is public funding for some of the most important institutions, such as MedCom, sundhed.dk and the Danish Health Data Authority, there are reliable figures for these:

The Ministry of Health, the regions and the municipal associations each contribute a third of the basic funding for MedCom. Operational responsibility for shared IT systems and infrastructure is funded by users by means of jointly agreed funding models.[444] In 2018, contributions from the regions totaled DKK 9.03 million (circa € 1.21 million),[445] while contributions from the municipalities came to DKK 5.17 million (circa € 694,000).[446]

In 2017, operational costs for sundhed.dk amounted to DKK 414.7 million (circa € 55.6 million).[447] From 2016 to 2020, DKK 20 million will be provided for specific initiatives to implement the new digitalization strategy.[448]

The Danish Health Data Authority is funded with around DKK 309 million per year (circa € 41.5 million).[449]

Actors and institutions

In summary, the following constellation of stakeholders can be outlined for Denmark:
the Ministry of Health is responsible for determining the general framework for providing healthcare and aged care, including legislation on the organization and provision of healthcare and aged care services, patient rights, healthcare professions, hospitals and pharmacies, pharmaceuticals, vaccinations, prenatal care and child health. The legislation covers the tasks of the regions, municipalities and public health authorities.

The five regions are led by the regional councils, which each consist of 41 members. The regions are responsible for hospital care, including emergency care and psychiatric care, as well as for healthcare provided by general practitioners and specialists in private practice, including dental care and physiotherapy. The contracts with general practitioners need to be renegotiated every two years. The regions organize healthcare services for their citizens according to the regional requirements, and the individual regions can adapt the services within the financial and national regulatory framework so that they can ensure the corresponding capacities.[450]

444 medcom.dk, (n.d). *MedCom-finansiering.* [online] Available at: https://www.medcom.dk/om-medcom/medcom-finansiering.

445 medcom.dk. (2018). *MedCom opkrævninger til regionerne i 2018.* [pdf] Available at: https://www.medcom.dk/media/8476/medcom-opkraevninger-til-regionerne-i-2018.pdf.

446 medcom.dk. (2018). *MedCom opkrævninger til kommunerne i 2018.* [pdf] Available at: https://www.medcom.dk/media/8475/medcom-opkraevninger-til-kommunerne-i-2018.pdf.

447 digst.dk, (2017). *Årsrapport.* [pdf] Available at: https://digst.dk/media/16482/digitaliseringsstyrelsens-aarsraport-2017.pdf.

448 sundhed.dk, (2016). *Strategi for sundhed.dk – 2016-18.* [pdf] Available at: https://www.sundhed.dk/content/cms/16/75816_sundheddk_strategirapport_2016_2018_web.pdf.

449 sundhedsdatastyrelsen.dk, (2017). *Årsrapport 2016.* [pdf] Available at: https://sundhedsdatastyrelsen.dk/-/media/sds/filer/om-styrelsen/aarsrapport-sundhedsdatastyrelsen-2016.pdf?la=da.

450 Danish Ministry of Health (2012). *eHealth in Denmark – eHealth as part of a coherent Danish health care system.* Danish Ministry of Health, Copenhagen.

The 98 municipalities are local administrative bodies governed by municipal councils. The municipalities are responsible for a number of healthcare and social services. Local healthcare and aged care services include disease prevention, health promotion, rehabilitation outside of hospital, home nursing, school health services, child dental treatment, child nursing, physiotherapy, alcohol and drug abuse treatment, home care services, long-term care facilities, and other services for elderly people. [451, 452]

The role of the Danish Health Authority comprises advising the Danish Ministry of Health and other public, regional, and municipal healthcare and aged care authorities. The Danish Health Authority cooperates with medical institutions, municipalities, private operators and civil society, and works across sectors in order to find the best solutions.[453]

The Danish National Board of eHealth was founded in 2011 as an agency of the Ministry of Health. It is responsible for developing and maintaining a national catalogue of IT standards for use in the healthcare system, for consolidating national health registries and systems, for improving services in the healthcare sector such as real-time financial data, and for implementing specific intersectoral initiatives, such as the Shared Medication Record, as determined in annual budget agreements and based on fixed targets and milestones.[454]

The Danish Medicines Agency is part of the Ministry of Health, and generally focuses on the pharmaceutical market. Its main tasks comprise authorizing and inspecting pharmaceutical companies, licensing pharmaceutical products, monitoring potential adverse reactions to medications, and authorizing clinical trials. In cooperation with other regulatory authorities in Denmark and the EU, it contributes to the development of policies and regulations in the pharmaceutical area.[455]

Founded in 2011, the Agency for Digitisation is an agency within the Ministry of Finance that is in charge of the government's digitalization policies. The agency is responsible for the implementation of the government's digital ambitions and the use of digital welfare technology in the public sector.[456]

The Danish Health Data Authority is subordinated to the Ministry of Health. The agency is responsible for 140 IT systems, including 60 national registries (among them the national health registry, which has been in use in all Danish hospitals for 40 years, as well as the national cancer registry). Other tasks include the evaluation of diagnosis related groups,[457] cross-sector digital health systems, and infrastructure shared between service providers (such as the medication plan of every patient that all service providers have access to).[458]

451 Ibid.
452 Ministry of Health (2017). *Digitisation and Health Data. Healthcare in Denmark – An Overview.* Indenrigs- og Sundhedsministeriet, København.
453 sst.dk, (2017). *About us.* [online] Available at: https://www.sst.dk/en/about-us.
454 Danish Ministry of Health (2012). *eHealth in Denmark – eHealth as part of a coherent Danish health care system.* Danish Ministry of Health, Copenhagen.
455 laegemiddelstyrelsen.dk, (2016). *About us.* [online] Available at: https://laegemiddelstyrelsen.dk/en/about/.
456 digst.dk. *About the Agency for Digitisation.* [online] Available at: https://en.digst.dk/about-us/.
457 This denotes a classification system for a flat-rate billing process, in which a large number of different diagnoses and combinations of procedures are classified into groups that are medico-clinically homogenous and have comparable costs.
458 Sundhedsdatastyrelsen.dk, (n.d.). Sundhedsdatastyrelsen offizielle Webseite, [online] Available at: https://sundhedsdatastyrelsen.dk.

Founded in 1994, MedCom is a non-profit organization that is financed by the Ministry of Health, the regions, and the municipalities. MedCom was established with the objective of developing standards and profiles for the exchange of health data and health-relevant data between hospitals, outpatient physicians, and other private stakeholders in the health sector (such as pharmacies, health insurance funds, and private caregivers). These data include text-based clinical reports, such as discharge papers, referrals, laboratory results, prescriptions and claims forms. [459, 460]

6.3.3 Digital health governance

Strategies and laws

The formulation of the National Strategy for Digitisation of the Danish Healthcare Service 2008-2012 is primarily a result of the regions developing their own individual EHRs, which, in turn, meant that a single national EHR system was never developed. The strategy's first objective was the implementation of the Shared Medication Record, a type of patient summary, which would then represent a national solution. In addition, the strategy contained telemedical solutions and the introduction of a national patient index.

In retrospect, the regulation or approach of having each region develop its own EHR system involved considerable financial and human resources. The reduction of the number of municipalities facilitated the ongoing process towards easier access to data across the regions, and was also one of the largest administrative reforms ever conducted in Denmark.[461]

The National Action Plan for Dissemination of Telemedicine consists of five specific telemedicine initiatives that form the foundation of a telemedicine program with which future measures for the development of telemedicine can be expedited.

As part of the large-scale introduction of telemedical care, corresponding national infrastructure will be built. This includes standards and relevant reference architecture, covering data measurement, videos, questionnaires and images. The goal is to develop digital infrastructure and IT architecture in the foreseeable future to enable relevant information to be exchanged across the healthcare system and other sectors.[462]

A large number of digital health and digitalization strategies have historically promoted patient participation in the processes of improving their own health, the use of digital health applications, and the integration of the various systems. The current strategies include:

- Citizen and Patient Involvement Strategy 2017: part of the larger communications strategy of the Danish Patient Safety Authority. The involvement strategy is guided by three values: openness, innovation, and trustworthiness. The main aspects of the strategy are
  a) involving the public in processes that influence the execution of the key tasks of the authorities,

459 medcom.dk, (n.d.). MedCom official website, [online] Available at: https://www.medcom.dk/medcom-in-english.
460 Danish Ministry of Health (2012). *eHealth in Denmark – eHealth as part of a coherent Danish health care system.* Danish Ministry of Health, Copenhagen.
461 Christiansen, T. (2012). Ten years of structural reforms in Danish healthcare. *Health Policy,* 106(2), pp. 114-119. doi:10.1016/j.healthpol.2012.03.019.
462 Ministry of Health (2017). *Digitisation and Health Data. Healthcare in Denmark – An Overview.* Indenrigs- og Sundhedsministeriet, København.

TABLE 42: **Denmark's digital health timeline**

Year	Strategy / Legislative proposal
1994	Foundation of MedCom
1999	National Strategy for IT in the Hospital System 2000–2002
2003	National IT Strategy for the Danish Health Service 2003–2007
2005	New Health Act
2007	Structural reform to reduce the number of municipalities
2007	National Strategy for Digitisation of the Danish Healthcare Service 2008–2012
2012	National Action Plan for Dissemination of Telemedicine 2012–2015
2013	National Strategy for Digitisation of the Danish Healthcare Sector 2013–2017
2014	The Shared Medical Record becomes an integral tool for healthcare providers
2018	A Coherent and Trustworthy Health Network for All – Digital Health Strategy 2018–2022

Source: Bertelsmann Stiftung

b) including the public in processes that encourage risk management and quality assurance, and
c) the evaluation of public involvement by the Communications Department.

- Digital Strategy 2016-2020: the strategy pursues the vision of improving the efficiency and quality of public services through digitalization. The strategy aims to significantly increase the public's trust in digitalization. It promotes the cooperation of companies and the government at the national, regional, and local levels.

A Coherent and Trustworthy Health Network for All – Digital Health Strategy 2018–2022: focuses on high quality health apps for mobile use (such as a patient handbook, patient forums, and a mobile EHR), extensive guidelines for the proper use of various healthcare devices, and more digital applications for chronically ill or pregnant patients (a handbook with information for midwives, online appointment booking, etc.). The aim is that the patient need no longer leave home to visit healthcare providers, as they will able to obtain the necessary information on sundhed.dk. The current strategy is focused on integrating all sectors of social and healthcare services with each other. Up to now, the exchange between the sectors has been message-based; although outpatient physicians can view the hospital record on sundhed.dk, hospitals cannot view the records of outpatient physicians. Outpatient physicians are also not able to access the records of other outpatient physicians.

As those responsible now have a positive assessment of the general health competence of Danes (in 2011, 44 % of 65-89 year-olds did not use the internet; in 2016, this figure was only 19 %),[463] this strategy/these strategies focus particularly on patient empowerment and patient-centered care. Patients should be granted maximum ownership of their own health, and be able to decide on their own when a visit to a physician or a hospital is necessary, what the next steps are, and how they can send relevant data to the responsible physicians by digital means.

463 sundhed.dk, (2016). *Strategi for sundhed.dk – 2016–18.* [pdf] Available at: https://www.sundhed.dk/content/cms/16/75816_sundheddk_strategirapport_2016_2018_web.pdf.

Institutional anchoring

The Danish National Board of eHealth serves as a central platform for the exchange between the central government, the regions and the municipalities, in order to consistently promote the digitalization of the healthcare system. To guarantee this exchange, the board is composed of representatives from the previously mentioned groups. Among other measures, the board ordered the development of the National Strategy for Digitisation of the Danish Healthcare Sector 2013-2017. It is responsible for the monitoring and implementation of the budgeted initiatives of the digital health strategies, as well as other strategically important projects.[464] The annual budget is politically negotiated. Strategic decisions are made by the board, whereas the tactical decisions are made by MedCom, sundhed.dk and the individual steering groups.[465]

Political leadership

In Denmark, there are neither strong proponents of digital health, nor are there particularly strong political roles for digital health. The involvement of individual ministers affects the prioritization of individual measures rather than the development of entire agendas. This results in a certain continuity, as changes in government have a minimal impact on the digital health agenda. At the same time, there is no strong political will for the Minister of Health to assume responsibility for a national EHR; success and failure should remain with the regions.[466]

The strong position of the regions in Denmark's healthcare system means that the regions are not controlled directly, but rather through the respective budget expenditures and allocations for specific projects. As the budget and the projects are determined in consensus negotiations between the Ministry of Health and the regions, it is much easier to implement plans than in healthcare systems with many potential veto actors. The main stakeholders are the regions themselves; physicians and their representatives are less involved in political decisions.[467] The regions, however, also demand corresponding budgets when a political decision has been reached for them to implement something.

6.3.4 Impact analysis

The observed influence of different variables on the process of digitalization in Denmark is outlined below.

The following observations were made regarding the individual variables:

Country and population size: No effect can be observed among the variables examined.
Observed effect: 0

State and government form: The parliamentary monarchy has no active influence on digitalization.
Observed effect: 0

Political order: centralism vs. federalism and subsidiarity: Denmark's central government has played barely any role in digitalization thus far. Regional projects are of greater importance, but

464 Statens Serum Institut (2013). Making eHealth work – National Strategy for Digitalisation of the Danish Healthcare Sector 2013-2017. SSI, The National eHealth Authority, Copenhagen.
465 Interview, Denmark study trip.
466 Ibid.
467 Interview, study trip.

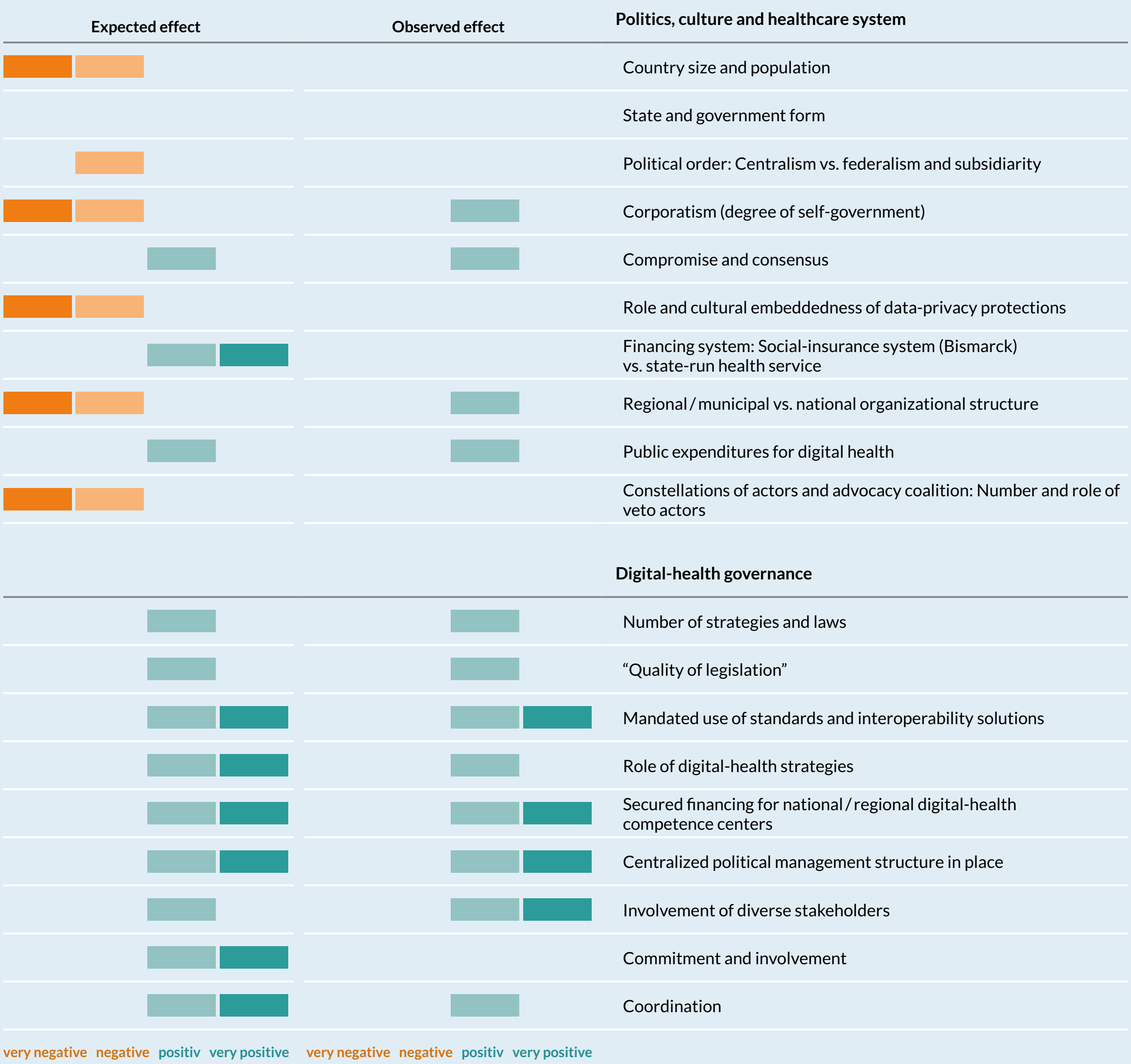
this cannot be attributed to federalism. As there is no federalism, this cannot be assessed either. Observed effect: 0

Corporatism (degree of self-government): The high level of autonomy and strong competencies of the regions have allowed digital health projects to be developed and scaled up over time. Observed effect: +

Compromise and consensus: There is a positive attitude to compromise and consensus within society and especially in political debate. This facilitates the introduction of digitalization. Observed effect: +

Role and cultural embeddedness of data protection: The Danes are very liberal with their data and have a positive attitude towards digital services. Data protection considerations could not be determined, so no effect was assessed. Observed effect: 0

FIGURE 57: **Expected vs. observed effect of influencing variables on the state of digitalization – Denmark**



Source: Bertelsmann Stiftung

Financing system: social security system (Bismarck) vs. public healthcare service (Beveridge) vs. hybrid systems: In Denmark, the type of healthcare system plays a subordinate role. Observed effect: 0

Regional / municipal vs. national organization: The strong regional organization of the healthcare system has demonstrated significant advantages for the digitalization of Denmark. Observed effect: +

Public expenditure on digital health: The operation of the highly successful national health portal is included in digital health expenditure. Observed effect: +

Actor constellations and advocacy coalitions: There are relatively few actors with influence on digitalization. As such, correspondingly few coalitions can be observed that support or hinder digitalization. Observed effect: 0

Number of strategies and laws: Denmark has repeatedly drafted targeted digitalization strategies over a long period of time, which has contributed to effective implementation. Observed effect: +

Quality of legislation: Denmark rarely passes new and specific digital health laws, but rather attempts to amend the existing laws. Observed effect: +

Binding application of standards and interoperability solutions: Publicly financed by the central government, the regions and the municipalities, MedCom develops standards that are applied in the manner specified. Observed effect: + +

Role of digital health strategies: Firmly anchored objectives and framework conditions in the strategies facilitate the steering and accomplishment of projects. Observed effect: +

Secured financing for national / regional digital health competence centers: MedCom and sundhed.dk are particularly worth mentioning in this context. Both are publically financed and play a key role in digitalization. Observed effect: + +

Central political management installed: The Danish National Board of eHealth is an agency of the Ministry of Health. The board defines the content of the strategies, and coordinates between the regions and other stakeholders. Observed effect: + +

Involvement of diverse stakeholders: The Danes place great value on end user inclusion, including with the assistance of focus groups. MedCom and sundhed.dk also directly address users and regions. Observed effect: + +

Commitment and involvement: No pronounced political involvement could be observed, so there was no noticeable effect. Observed effect: 0

Coordination: Once again, the role of the Danish National Board of eHealth bears mentioning, which defines the objectives and budget allowances of individual stakeholders. Observed effect: +

The above-listed information has been graphically depicted in figure 57. This presents the observations in bars ranging from very negative (dark orange) to very positive (dark green). Figure 57 describes the above-mentioned expected effects of the individual indicators on the state of digitalization. In the following section, the individual variables and their mode of action on digitalization are highlighted and described in greater detail.

Incremental developments toward digital health

A great deal of the digital health solutions available in Denmark today originated largely in local initiatives and projects. For example, many hospitals initially started with their own systems, and MedCom was also (further) developed within the framework of European projects. In 2006, there were around 26 different systems for EHRs in hospitals in Denmark.[468] This local development and variety was picked up by policymakers, and an objective was derived to connect all hospitals. As this approach proved to be too large and too difficult, an initial decision was taken to harmonize the regions individually.

The implemented structural reform has certainly made a positive contribution to digitalization: due to the reduced number of municipalities, it was much easier to reach the decision in 2010 that each region should have its own system, and every hospital within a region should use the same system. Since 2014, there have been four different systems used in the five regions of Denmark; two of the regions use the same system.

An additional factor that has contributed to the digitalization of the healthcare sector in Denmark is the introduction of the NemID for digital administration. This existing infrastructure could then also be applied to digital health, and used by sundhed.dk, among others.

However, the process of digitalization does not simply happen by itself in Denmark either. After a six to eight year period of stagnation, digitalization is accelerating once again. During this slow period, there were political considerations on the allocation of competencies with respect to the governance of the healthcare system. As such, the focus of the development of digital health during this time was primarily on the development of a governance structure, such as for the medication plan. This period of stagnation was the result of insufficient structures. A review had to be undertaken regarding what had already been accomplished digitally, which structures were present, and which additional structures were required.[469]

Standards and their implementation

Much in the field of digital health in Denmark is involved with the implementation and enforcement of standards. For example, the decision on the integration of the regional systems was accompanied by the decision to mandatorily apply the standards developed by MedCom on the cross-sector exchange of data. These interoperability standards developed by MedCom were then introduced as mandatory standards by the Danish Health Data Authority.

However, it was recognized that although standards and interoperability are useful, they may not always be able to be complied with in their final implementation. The effort of adapting existing systems to new standards can be too high, or the functionality cannot always be guaranteed. Standards are correspondingly reinterpreted in individual cases until a new workable foundation is formed. From a technical perspective, establishing interoperability for various existing systems is less of an issue for system developers and process designers than implementing or adapting to new standards. Here, much can be adapted retrospectively; the example of the digital medication plan used in standard care shows that components that are almost 20 years old are still being used. To introduce changes here would take considerable effort that would not be justified by the expected added value. However, the medication plan can be so designed as to be interoperable with new systems.

The key message is that the application of standards should be welcomed, but their value should not be overstated. Too many binding standards can restrict new and additional developments. Interoperability, however, should be encouraged. There are enough levels to over-

468 Ibid.
469 Ibid.

come between the political and technical levels. The objectives should be defined politically, but the technical implementation should be left to others, such as MedCom.[470]

National healthcare system vs. regions

The national healthcare service and the centrality of the administration represent particularly important variables in the digitalization of the Danish healthcare system. Through targeted financial management, the projects defined by the Danish National Board of eHealth can be better addressed and managed by the regional administrations. The pressure to implement projects is financial in nature, and thus more tangible to the participants.

The position of the regions in Demark also offers an additional advantage. Though the incremental development of digital health, particularly within the regions, the various applications can be scaled up from small to large. A relatively homogenous digital health landscape has been able develop through this process. At the same time, national and central solutions have not been able to be pushed through. However, at the regional level, smaller projects can be introduced and implemented. With respect to national data exchange, the decentralized storage of data within the regions should be regarded as a positive for reasons of technical security and data protection.

Strategy and coordination

Denmark already has some past experience with digitalization strategies. Often, general visions and roadmaps were outlined in which the proposed projects were adapted until they met the requirements of the strategy. This did not allow any targeted control. Today, the strategies correspond more to an action plan. The current strategy represents an actual framework with specific provisions and targets, and corresponding budget allocations for specific activities. Accordingly, the effectiveness of these strategies has also been positively assessed by participating stakeholders.[471]

In principle, the Danish stakeholders assume that the strategic measures have to be inspired by and integrated into the overall development of the healthcare system. This background explains why earlier digitalization strategies that were delivered as stand-alone solutions did not always arrive at the successes intended by their authors. Among other things, the described regional incremental development and the previously existing NemID infrastructure for digital administration play a role here. The most current digitalization strategy of the healthcare sector also fits in with the overall development of the system. It goes hand in hand with the new national hospital strategy, which aims to reduce the number of specialist hospitals from 40 to 20 while increasing the level of digitalization in hospitals.[472]

Good coordination of the participating stakeholders is important for the implementation of the strategies. Denmark has done a convincing job in this respect: the position of the Danish National Board of eHealth ensures that the most important representatives of the most important stakeholders sit together in an agency of the Ministry of Health, allowing steering to be centrally influenced. The implementation of strategic projects is managed by a traffic light system. Status reports have to be submitted to the Danish National Board of eHealth on a regular basis, and a traffic light color is assigned depending on the imple-

470 Ibid.
471 Ibid.
472 Ibid.

mentation status. This allows the government, as the central financer, to easily identify which projects are on track, and which ones are not. This facilitates the control and thus the steering of digitalization.

User participation

The participation of the various healthcare system stakeholders in the development of digital health solutions is of central importance. Different forms of participation can be seen in Switzerland and in the Netherlands, as can differing levels of success. In comparison to both of these countries, the end user is particularly involved in the development of digital health solutions in Denmark. To this purpose, among other measures, anthropologists were tasked with investigating expectations relating to digital health solutions by means of focus group interviews with physicians and patients. It was shown that continuity of treatment, also by different service providers, is a central (and lacking) element for patients. The system is to be further developed based on these and other findings. In the beginning, an attempt was made to digitize all paper-based processes in the EHR, which gave rise to equivocal results and barely any practical outcomes. Based on the cooperation with end users, especially the physicians, attempts are now being made to find solutions for this same problem.

On the one hand, cases may arise where physicians may voice their displeasure at the introduction of digital solutions, and may even go so far as to resign from their positions. There can be many reasons for this: a lack of resources and time to use digital resources, too many patients and thus too great a time commitment, complaints about the system, and so on. On the other hand, the use of the system by end users and other physicians may spread the workload to other participants, and thus facilitate introduction. Experience in the regions has shown that the implementation of an EHR can still present a problem. For physicians, it may be too complex a system for everyday activities, and may not fit treatment routines. In many places, however, the experience has been that it is not the EHR that is the problem, but rather the underlying systems for the treatment routines in hospitals. The introduction of, for example, non-European, proprietary hospital information systems has proven particularly problematic in certain regions, as they can adapted to the Danish systems only with great difficulty. This is not a structural problem of the Danish EHR, but that of the manufacturer.

As the developer and operator of the national platform, sundhed.dk proactively approaches hospitals to assist with development. sundhed.dk visits these hospitals in order to speak with hospital staff, gather findings, and raise awareness of the system. At the same time, criticism from its own members (the regions) is actively taken into account. The health directors of the regions are involved, their requirements determined, and the added value that sundhed.dk can bring to the respective region is indicated. sundhed.dk considers this step necessary in order to avoid the same critics in the respective committees and instead orient themselves directly on the needs of the end users. Representatives of the stakeholder organizations may not always represent the interests of their members, but rather their own (political) agendas. This is why priority is given to grassroots work, in order to increase the pressure through the end users.[473]

473 Ibid.

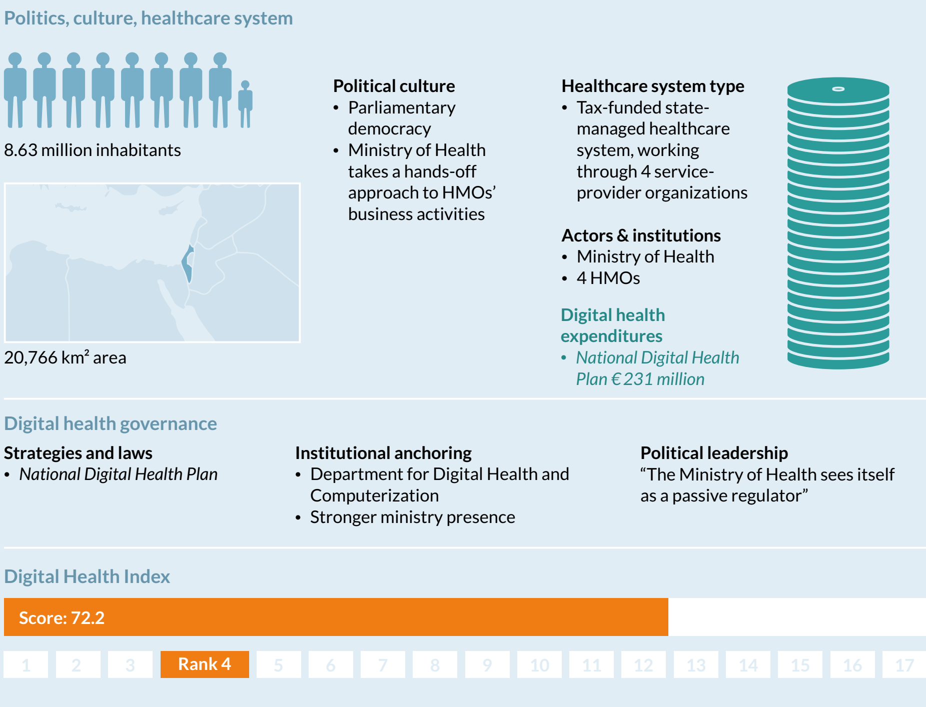
6.4 Israel

6.4.1 State of digitalization

Compared internationally, Israel has achieved a highly advanced state of digitalization. Due to growing healthcare-system challenges associated with an aging population, a cluster of patients with multiple diseases and the resulting increases in healthcare costs, the Israeli healthcare system is increasingly focused on digitalization. In this regard, the majority of digital health applications derive from the competition between and the initiative of the four large *health maintenance organizations* (HMOs) rather than from the influence of the government. Only recently has the government begun to increase its regulatory influence on the exchange of healthcare-information exchange, promoting the development of an independent network that encompasses all of the HMOs. As a result, there is currently no national strategy for the introduction of digital-health applications; all that exists in this regard is an overarching information and e-strategy from the year 2004.[474]

The HMOs have been networked with one another through a so-called *health information exchange network* since 2014. The two largest HMOs, Clalit and Maccabi,[475] currently operate their own research programs, with big-data analytics addressed particularly through the use of a national Health Ministry platform.

FIGURE 58: **Israel country profile**



Source: Bertelsmann Stiftung

474 Rosen, Waitzberg and Merkus. (2015). Israel – Health System review. *Health Systems in Transition.* 17 (6), pp. 1-212.
475 Interviews, Israel study trip

An electronic health record (EHR) system, the so-called *Electronic Medical Record* (EMR), serves the entire population in Israel, but is maintained internally by each individual HMO.[476] Because all four providers offer their members patient records of this kind, the choice to join a particular HMO is typically based on more than this EHR service. In addition to the internally maintained patient records, there is also the Clalit-developed OFEK system, which has become a national standard. OFEK is a medical-record system that is available to all healthcare institutions, across HMO borders. The electronic records give physicians, particularly those offering telemedicine services, immediate access to all relevant data in their patients' medical histories, a crucial factor in emergencies. From a technical perspective, the records can be easily accessed by most physicians. However, not all healthcare service providers have access to the EMR systems or to the OFEK network. Hospitals in particular often lack access, especially since one-third of the hospitals operated by the Health Ministry lack the technical ability to connect to OFEK. In the case of other hospitals, the situation is only slightly better. For example, only about 30 percent of Clalit hospitals are equipped with the necessary EMR software. Small, independent hospitals are typically not connected to the system. This unfortunate state of affairs is currently being addressed, in particular through a focus on overcoming technical barriers in the hospitals.[477]

The electronic health record system has also enabled Israel to place a strong focus on telemedicine. For example, there are special centers in which medical personnel are available around the clock. These staffers can quickly retrieve a complete patient summary if a patient calls. These centers help improve basic care, taking a burden off the healthcare system as a whole.

In addition to the electronic health records, Clalit and the other HMOS have their own databases[478] that contain laboratory results, disease registries, diagnoses, x-ray images and prescriptions. These are also linked to national databases such as the cancer registry. Clalit's internal personal patient records (EHRs), which are based on this database system, provide a complete representation of patients' medical histories. They include diagnoses, laboratory results with interpretations in layperson's language, allergies, vaccinations, medications, simple explanations of medication dosage instructions, and important side effects and contraindications. The EHR can be exchanged across all Clalit-affiliated institutions.[479]

Excerpts from the full Clalit record are compiled on demand, and form the basis for physicians' consultations. This data is not permanently stored with the doctor who has retrieved it; rather, the excerpts used are automatically deleted as soon as the physician ends the consultation. However, an entry is created in the underlying record, indicating when and where the patient data was accessed. A similar system exists for the two large Jerusalem hospitals in cooperation with the Maccabi and Meuchedet HMOs.

Overall, Israel is relatively advanced, particularly because many of the applications in the digital sphere have been in established use for more than 10 years, and indeed have been (and continue to be) developed further since that time. The Israeli public also demonstrates a high adoption rate of digital applications. This is partly evident in the high number of patients taking advantage of eVisits, which are telemedicine-based consultations that

476 Rabinovich, A. ISRAEL – HealthCare IT Industry, Jerusalem.
477 Interview, Israel study trip
478 Ibid.
479 Crounse, B. (2011). *World Class e-Health at Clalit Health Services in Israel.* [online] Available at: https://blogs.msdn.microsoft.com/healthblog/2011/05/02/world-class-e-health-at-clalit-health-services-in-israel/

substitute for a traditional visit to a doctor's practice. Fully 20 percent of visits to Maccabi-affiliated doctors, for example, already take place only in digital form.[480] Additional services such as ePrescriptions have also been put in place for all patients and are already widely used. Patients are still provided with paper-based prescriptions only in the context of supplemental insurance plans, which are primarily aimed at the healthier portion of the population.

6.4.2 Structures and characteristics

Country characteristics

With an area of just 20,766 km, Israel is the smallest of our five surveyed countries. However, it has a total of 8.63 million residents, somewhat more than Switzerland. Israel is a parliamentary democracy. The country is represented by its president, and governed by the Israeli cabinet, which is headed by the prime minister. One special feature is the institution of the ombudsman, a state-oversight body independent of the government that is responsible for conducting external financial audits of the public administration, and additionally monitors state authorities' legality, proper functioning and economic efficiency. These competences extend to state-owned enterprises and other public institutions.

Israel is divided into six administrative districts, with 15 sub-districts. Local governance thus takes place at three different levels: municipalities, local councils and regional councils. Municipal governments are responsible for localities with more than 20,000 residents, local councils for areas with 2,000 to 20,000 residents, and regional councils represent the smallest administrative unit, with their jurisdiction typically covering numerous localities that each have fewer than 2,000 residents. Local-government authorities are responsible for establishing primary and secondary schools, kindergartens, cultural centers and hospitals, and for constructing and maintaining the road network, public parks and water systems. They also handle garbage collection and social services.

Israel holds 21st place in the Networked Readiness Index (NRI), the second-to-last place among the surveyed countries. This result indicates that conditions for establishing digital applications tend to be more difficult in Israel than in the Netherlands, Switzerland, Denmark or Germany. However, the significance of the NRI results are clearly limited

TABLE 43: **Networked Readiness Index 2016**

	Rank 2015		Rank 2016
Netherlands	4	↓	6
Switzerland	6	↓	7
Denmark	15	↑	11
Germany	13	↓	15
Israel	21	→	**21**
France	26	↑	24

Source: Baller, S., Dutta, S. und Lanvin, B. (2016). The Global Information Technology Report 2016 – Innovating in the Digital Economy. World Economic Forum, Genf.

480 Interview, Israel study trip

with respect to digital health, as Israel achieves a significantly better result in the present report, with only Denmark ranking higher.

Political culture

Religious issues fundamentally play a dominant role in Israel's politics. This creates strongly polarized positions between the parties, which in turns complicates efforts to reach political compromise. Healthcare policies are handled by two committees in parliament, the Finance Committee and the Labor, Welfare and Health Committee. Ultimately, many questions of healthcare policy are linked to the government's financial policy and the approval of the state budget.[481]

The role of the healthcare ministry consists in planning and setting healthcare goals, preparing healthcare-related legislation, and monitoring and promoting the public health. The ministry uses legal regulation to provide a framework in which the HMOs can independently take measures to achieve their objectives.[482] As a matter of principle, the ministry tends not to intervene in the affairs of the HMOs; however, in some cases, it may require that existing digital solutions be used. As a rule, the ministry tries to minimize its regulatory interventions, instead acting through guidelines toward which HMOs can orient their activity.[483]

The issues of data and data protection are viewed differently by Israel's physicians and patients. On the one hand, patients support technological innovation and digital services. On the other, they hold a certain antipathy toward the idea that money could be made using their healthcare data. However, in both parties, there is a prevailing assumption that the existence of patient data is fundamentally of benefit, even if not all data is always needed.[484]

Type of healthcare system

Compared with EU and OECD countries, overall healthcare-system costs in Israel are very low (accounting for a 7.6 % share of the total national budget, compared with an average 8.7 % in the European Union and 8.9 % in the OECD states). Moreover, this provides very good, broad-based care for the population (which has a comparatively very high life expectancy).[485] Israel's Ministry of Health is centrally positioned in the country's healthcare system, standing above all other health-sector actors. The ministry's core tasks include managing the state healthcare budget, developing legislation, introducing and monitoring medical and health standards, certifying medical professionals, promoting research and development, and regulating the healthcare sector. It thus acts as a regulatory body, while also holding responsibility for cost reimbursements, audits and the general oversight of all other bodies. In some cases – for example, with regard to privately operated nursing homes – the ministry is involved only as the payer. The ministry also provides the national IT infrastructure, enabling any information (e. g., hospital-release information, laboratory reports, etc.) to be integrated into the electronic health records maintained by the four private *health maintenance organizations* (HMOs); moreover, it owns and operates nearly half of all national hospitals.

481 Rosen, Waitzberg and Merkus. (2015). Israel – Health System review. *Health Systems in Transition.* 17 (6), pp. 1–212.
482 Ibid.
483 Interview, Israel study trip
484 Ibid.
485 Rosen, Waitzberg and Merkus. (2015). Israel – Health System review. *Health Systems in Transition.* 17 (6), pp. 1–212.

The national health-insurance law came into effect in January 1995. This effectively created today's healthcare system, in which all members of the population are required to be insured through one of the four nonprofit HMOs. These HMOs are Clalit, Leumit, Maccabi and Meuhedet. Among these, Clalit is the largest provider, covering more than 60 percent of the population. The four competing HMOs are independent but work within a legal and regulatory framework set by the government. Citizens can choose freely between them and cannot be rejected by their HMO of choice.

Every HMO member pays a contribution determined on the basis of income class; there are two such income classes, set for the HMOs by the Health Ministry on the basis of fixed criteria. In addition, there are deductibles for treatment costs. Each HMO member is entitled to the same quality and same range of medical services, as formulated by the Health Ministry in a set, standardized catalog of services. A formal review and update of this catalog of services takes place annually.

Israel has a nationwide primary-care system, in which general practitioners act as gatekeepers for other healthcare services such as specialists and hospitals. Most medical professionals in the healthcare sector work for HMOs, either as salaried or independent physicians. Nearly half of all hospitals are owned by the government; about 30 percent belong to Clalit, and the remainder are in other public or private hands.

The Israeli healthcare system is divided into two levels:

1. A regulatory level, encompassing the central government and the Ministry of Health, which also operates regional health offices, the largest single share of the country's hospitals, and numerous family health centers, among other institutions; and
2. The four HMOs, which as healthcare service providers are responsible for primary care. To this end, the HMOs either operate medical practices directly, or have close cooperative agreements with private general practitioners and hospitals. Physicians are generally salaried by the HMOs. Clalit, the largest provider, owns about one-third of all hospitals. On the local level, there are additional smaller hospitals and healthcare service providers.

Pharmacists in Israel have more decision-making freedom than their counterparts in Germany. Their powers go beyond simply dispensing medications to patients according to doctors' prescriptions, as they are also entitled to increase or reduce dosages on their own if this appears sensible to them.[486]

Digital health expenditures

The so-called *National Digital Health Plan* put forward in March 2018 provides a budget of approximately € 225 million. Of this, about € 151 million is to be invested in the construction of digital infrastructure for medical research, with an additional € 54 million provided for research and development purposes in the Israeli academic community and local technology sector. The remaining funds are to be used in the creation of regulatory frameworks such as sectoral regulations, certificates and funding programs, or invested in academic scholarships.[487]

486 Interview, Israel study trip

487 Krupsky, S. (2018). *Israel Approves $264 Million National Digital Health Program.* [online] CTech. Available at: https://www.calcalistech.com/ctech/articles/0,7340,L-3734832,00.html

Beyond this, no explicit expenditures for digital-health purposes have been made public. The Health Ministry's regular funding for the HMOs and hospitals is issued on the basis of fixed parameters, such as the number of patients and the age structure of the HMOs' members. This includes funds earmarked for research and development. However, no specific figures are available in this area.

Actors and institutions

In addition to the Health Ministry, there are four healthcare organizations (HMOs) in Israel that are responsible for the population's care. While these act in part as health insurers, they also operate hospitals, laboratories and databases, and in some cases have cooperative agreements with various private service providers. In addition to basic healthcare services, the HMOs share responsibility with the ministry for the conduct of healthcare-related research, and are tasked with ensuring the functioning of the EMR system and electronic healthcare services more generally. The HMOs are very differently constituted, and in addition to primary care, also provide pharmaceutical services, geriatric care and alternative-medicine treatments.

The oldest and largest HMO, Clalit (founded in 1911), provides care for more than half of Israel's population. Overall, Clalit is mainly focused on primary care, and tries to offer all healthcare services internally. The HMO manages and owns its own hospitals and laboratory facilities in the country, among its other activities. Thanks to these efforts, Clalit is seen by many as having pioneered a number of innovations in the Israeli healthcare system. Among other achievements, it developed the OFEK project, an electronic health record system that today has been adopted by the Health Ministry as a national IT-infrastructure standard. OFEK is today available to all healthcare institutions such as hospitals.[488]

The second-largest HMO, Maccabi, is part of the Maccabi Healthcare Services Group. Its members have access to services provided by the entire Maccabi network, including the Assuta hospital network; Maccabi Pharm, a group of about 100 pharmacies; Bayit Balev, a care network for elderly people that includes nursing homes; and Maccabi Tivi, a network for alternative-medicine care. Contracts for consultations or further treatment are exchanged between these entities, so that the network's structure as a whole strongly resembles that of Clalit.

Due to different needs in different parts of the country, which includes large cities, desert regions, agricultural areas, etc., some areas have only HMO-operated hospitals, while others have only state-operated or other third-party services. Overall, this produces a nationwide system of care that enables all patients to be cared for in all hospitals in cases of emergency. However, due to reimbursement restrictions, the HMOs actively seek to treat their members exclusively with their own affiliated physicians.

488 Interview, Israel study trip

6.4.3 Digital-health governance

Strategies and laws

In Israel, questions having to do with the actual provision of services or digital health strategies are primarily the responsibility of the HMOs, which independently pursue new innovations. The state primarily provides a general healthcare-policy framework. However, if a specific application produces particularly positive results, the ministry can coordinate a nationwide dialogue to address concrete HMO proposals on the issue. Accordingly, Israel's digital health legal environment consists mostly of framework laws, which typically do not contain specific objectives. At the same time, this approach also means that the four HMOs typically already act at the national level due to their organizational structures,[489] and coordination between systems simply takes place between the HMOs. In this regard, while all four organizations offer services across the country, the services are in some cases available to different degrees in different areas; that is, the four providers do not always compete to the same degree in some regions.

Digital Israel is a government initiative aimed at promoting digitalization and innovation in all areas of life. Through this vehicle, the Health Ministry has actively intervened in shaping the healthcare sector for several years.[490] Otherwise, the topic of digital health has not to date featured significantly in the public discourse. Political processes have played only a small part in shaping the overall digital development in the healthcare sector. Instead, a policy framework has been created that facilitates free competition on a technical level.

Most of the country's digital health offerings, including telemedicine services, teleradiology, telediagnoses and ePrescriptions, began development as early as the 1990s. Patient portals have existed since 2001, and have long been used as a basis for the EMRs that are today used by 100 percent of the population. These services and their steady further development are primarily attributable to work by Clalit and Maccabi. The ministry's efforts in this area have primarily built on top of these developments. Because the HMOs themselves determine the degree to which they will digitize, and then carry out their plans independently, this approach has been very effective to date.

However, due to interoperability problems between the four HMOs' various applications, it has recently become politically useful for the ministry to take on a more active regulatory role. For example, the Ministry of Health is developing a cross-HMO strategy that sets national standards with the particular goal of avoiding interoperability issues. This ministry activity is taking place primarily at the level of guidelines coordinated in advance with the HMOs, and is only rarely taking the form of legislation. One example of this is the expansion of Clalit's OFEK healthcare data platform, which has been elevated to the status of a national standard, but without its use ever being made compulsory in the form of a law.

The current new strategy is part of a larger project to strengthen the innovative power of Israel's digital-health business sector, and to create conditions conducive to testing new technologies in direct cooperation with the HMOs.[491] There is no longer any need for

489 Clalit: *http://www.clalit-global.co.il/en/clinics.html,* Maccabi: *https://www.maccabi4u.co.il/1781-he/Maccabi.aspx,* Meuhedet: http://lang.meuhedet.co.il/, Leumit: https://www.leumit.co.il/eng/Useful/AboutLeumit/

490 Ministry for Social Equality, (2017). The Digital Israel National Initiative: The National Digital Program of the Government of Israel. Tel-Aviv.

491 Ministry of Health, (2018). *Creating a Healthy Future.* Israel.

TABLE 44: **Israel's digital health timeline**

Year	Strategy
1995	National Health Insurance Act
1996	Patient Rights Act
2018	National Digital Health Plan

Source: Bertelsmann Stiftung

implementation plans relating to "basic" digital health applications (electronic patient records, ePrescription systems, etc.) at the HMO level, since such technologies have been in operation for more than 10 years. In some cases they have also been updated, but for the most part they are already deployed nationwide. However, there is a need for approaches able to unify applications that to date have been deployed only within confined HMO circles, with the goal of making them usable across HMO borders. Under the rubric of the new *National Digital Health Plan*, adopted in 2018, new deployment plans and roadmaps have been created particularly in the areas of mHealth and innovation. These are primarily intended to assist digital health start-ups. The plan also aims to establish Israel as a global leader in the digital healthcare sector. The plan does not yet include specific standards.

Institutional anchoring

In Israel, there is no explicit state oversight of the quality or security of the HMOs' digital health services. Each HMO is itself responsible for ensuring the appropriate level of quality, and can be lawfully prosecuted for any violation of data-protection or patient rights. The Health Ministry's *Digital Health and Computerization* department is responsible for planning, developing and maintaining the technical infrastructure. In addition, this department assists the HMOs in their communication and coordination with one another.

Over the long term, an institutional change has taken place in Israel. The ministry today increasingly acts as a national coordinator for those areas in which the HMOs do not bear direct responsibility, such as communication with and coordination between the physicians affiliated with different providers. In the past, functions such as internal data exchange and the related infrastructure were financed by each individual HMO; this was because at this earlier point, the Health Ministry had not yet become active as a coordinator, and the current strategy regarding interoperability problems between multiple different systems did not yet exist.

The four HMOs undergo regular evaluations relating to the availability and quality of their services. All of the health organizations participate in the program, jointly influencing the conduct and focus of evaluations that take place under academic guidance using funds provided by the Health Ministry. From a legislative perspective, existing laws relating to data exchange and processing have been passed only on the HMOs' initiative. Previously, no legal framework existed in this area; the healthcare groups had only to comply with internal organizational rules.[492]

492 Interview, Israel study trip

Political leadership

In the past, the purchase and use of already-established solutions often resulted in coming too late and too slowly to market, according to the HMOs. In response, they – particularly Clalit as the largest provider – began to develop their own solutions for the problems specifically observed in Israel. The ministry has not functioned as an active initiator in this area; rather, it has regarded itself as a passive regulator in the already functioning innovation market that includes the four national HMOs.

The current change in this attitude has manifested itself particularly in the March 2018 Digital Health Plan. In this regard, the ministry has been pressed into a more active role in large part at the behest of the HMOs themselves. Prior to a ministry intervention, the procedure to be followed is coordinated jointly with the HMOs. The HMOs are allowed to submit multiple sets of comments, which are than incorporated into the final result.[493] The current digital health plan calls for investments of around € 260 million, which are in part intended to help Israel attain a leading role in the world digital health market. Israel's prime minister spoke in support of this position earlier this year, at the World Economic Forum in Davos.[494] The government sees a good opportunity to position Israeli actors successfully in the world market. However, it is also aware of the fact that many high-tech firms are insufficiently familiar with the working methods of healthcare organizations and agencies in key target markets. Therefore, the digital healthcare initiative is designed to bring together program participants in an association that supports the exchange of experiences and knowledge.[495]

6.4.4 Impact analysis

Below, we will address the observed influence of various variables on Israel's digital transformation.

The following observations were made regarding individual variables:

The statements made have once again been translated graphically into figure 59. This depicts the observations made here in the form of very negative (dark orange) to very positive (dark green) bars. The graphic below describes the individual indicators' expected effects on the state of digitalization, as outlined above. The individual variables and their impact on digitalization will be highlighted and examined in greater detail below.

The following observations were made regarding individual variables:

Country size and population: Although Israel is small in size and population, this involves no advantages for the country in terms of digitalization. Observed effect: 0

State and government form: The state and government form has neither a positive nor a negative effect on the state of state of digitalization. Observed effect: 0

493 Ibid.
494 Benmeleh, Y. (2018). *Israel to Invest $275 Million in Digital Health Project.* [online] Bloomberg. Available at: https://www.bloomberg.com/news/articles/2018-03-25/israel-to-invest-275-million-in-digital-health-project
495 Germany Trade & Invest (2018). *Israel beschließt Ausbauprogramm für digitale Gesundheit.* [online] Germany Trade & Invest official website. Available at: http://www.gtai.de/GTAI/Navigation/DE/Trade/Maerkte/suche,t=israel-beschliesst-ausbauprogramm-fuer-digitale-gesundheit,did=1917398.html

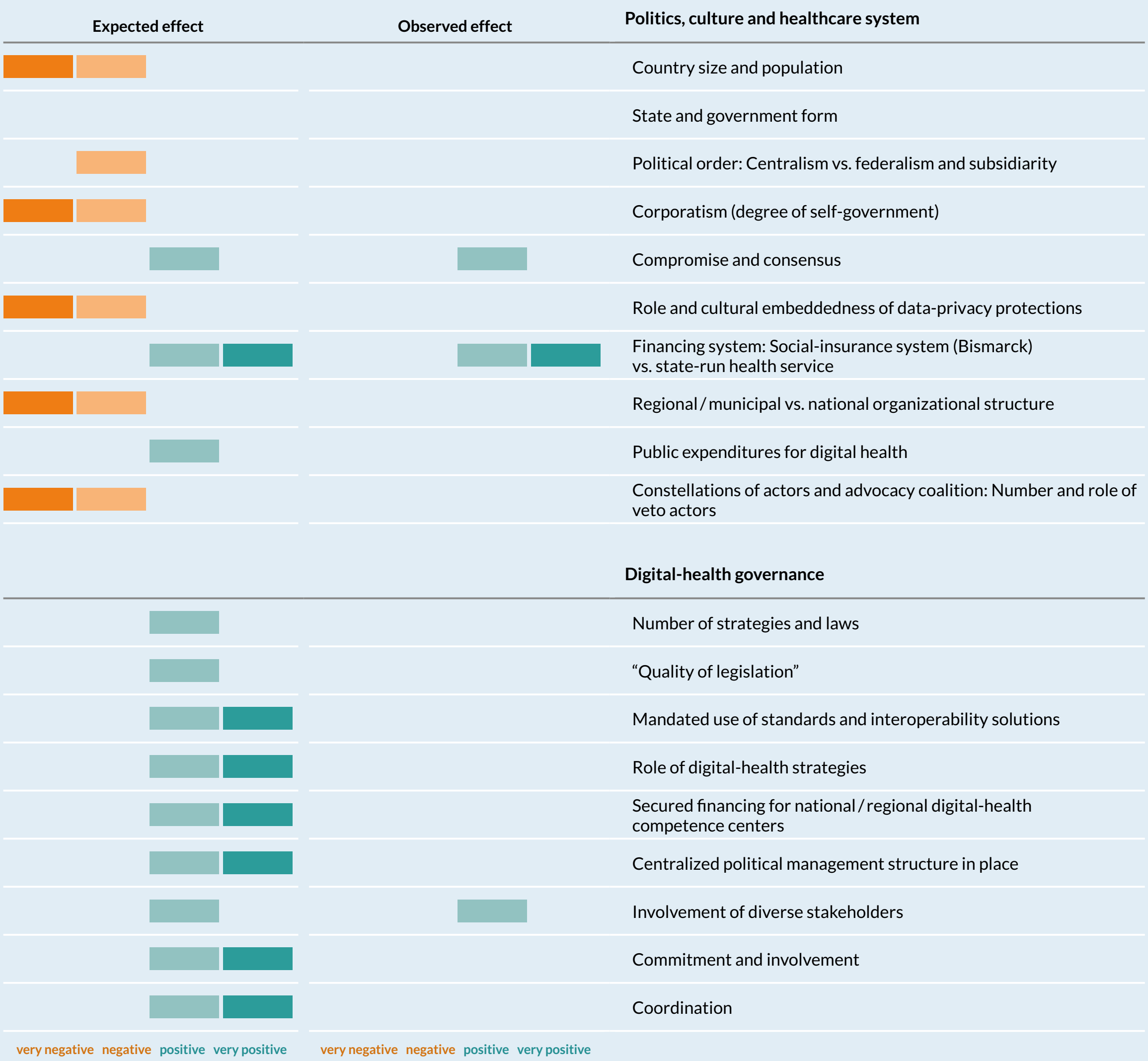
Political order: Centralism vs. federalism and subsidiarity: No advantages or disadvantages associated with this variable were identified. Observed effect: 0

Corporatism (degree of self-government): As self-governing bodies, Israel's four HMOs have been able to pursue digital transformation themselves, a development that has had a positive effect on the country's overal digitalization process. Observed effect: +

Compromise and consensus: Thanks to the small number of actors involved, consensus on digitalization is relatively high. This variable therefore has a positive impact on digitalization. Expected effect: +

Role and cultural embeddedness of data-privacy protections: It is broadly assumed in Israel that the availability of data for physicians and patients is a positive development, even if this data is not always used. No effect could be identified for this variable, as there are no identifiable concerns regarding data privacy issues. Observed effect: 0

FIGURE 59: **Expected vs. observed effect of influencing variables on the state of digitalization – Israel**



Source: Bertelsmann Stiftung

Financing system: Social-insurance system (Bismarck) vs. state-run health service (Beveridge) vs. hybrid system: The government's capacity to influence the healthcare system through its budget results in this variable having a positive impact on state healthcare services. Observed effect: ++

Regional / municipal vs. national organizational structure: Since the healthcare system is national and there is no regional structure, no effect for this variable was observed. Observed effect: 0

Public expenditures for digital health issues: Because digital health is not a budgetary line item, and HMOs instead have the authority to decide how funding is allocated, no direct impact of this variable could be identified. Observed effect: 0

Actor constellations and advocacy coalitions: Because the HMOs have the authority to make their own decisions, there are no veto actors to speak of in the Israeli system. Accordingly, no effect could be observed for this variable. Observed effect: 0

Number of strategies and laws: Despite the lack of legislation and framework conditions, Israel has nonetheless built up a system that works. However, the lack of strategic vision meant that the HMOs were compelled to take action by requesting that the government develop regulations and standards for a national solution. Observed effect: 0

Quality of legislation: Due to the lack of legislation, no meaningful statement can be made. No effect could therefore be identified for this variable. Observed effect: 0

Mandated use of standards and interoperability solutions: Because there are no binding standards to speak of, no meaningful statement can be made and no effect for this variable could be identified. The HMOs have developed their own standards, which is why no negative effect could be identified either. Observed effect: 0

Role of digital health strategies: The absence of a national digital health strategy until 2018 has left HMOs without a national objective in the development of their approaches. Accordingly, no effect could be observed for this variable. Observed effect: 0

Secured financing for national / regional digital-health competence centers: The absence of institutes with bundled expertise in digital health means that no effect for this variable could be determined. Observed effect: 0

Central political management installed: Since there is no political management of eHealth in Israel, no effect could be observed for this variable. Observed effect: 0

Involvement of diverse stakeholders: Israel's unique system in which all stakeholders are involved with HMOs and their digitalization process makes it easier to implement applications. This results in a slightly positive effect. Observed effect: +

Commitment and involvement: The government demonstrates no particular commitment to eHealth; no effect could be determined for this variable. Observed effect: 0

Coordination: The lack of policy coordination has generally had a negative effect on digitalization in Israel. However, the HMOs are themselves active enough to get what they need. Observed effect: 0

Central and efficient healthcare system

Many of the developments in Israel have been attributable to centralized guidance of the healthcare system in combination with independent elaboration by the HMOs. More than anything else, the cost efficiency with which Israel's healthcare system functions is notable. Building from a self-conception developed over a long period of time, the private HMOs began to take control and establish their own substantive areas of focus. One of these areas was the digitalization of their own systems. Indeed, within the individual HMOS, this process today ranks among the world's most advanced in comparison with other countries.

This development led the ministry to take a fundamentally passive role. Today, it is again intervening more intensively by providing a supportive regulatory framework, but a dynamic has emerged in which much continues to be demanded of the HMOs. A system has emerged in which the ministry creates clear added value for the entire healthcare system through its regulatory intervention, but only in situations that go beyond the areas of responsibility held by the individual HMOS. More typically, the ministry acts simply as a coordinator at the national level. The private service providers are largely responsible for financial investments and risks; for example, Clalit has co-financed 70 percent of the immediately usable digital innovations.

Few actors, plenty of action

One of the main reasons for the advanced state of digitalization in Israel is the low number of veto actors in the healthcare system. The oligopoly of only four HMOs provides for a certain amount of competition between them. At the same time, each of the providers tends to pursue technically comparable ideas, which is why developments have been pushed forward in a very focused way, with hardly any conflict of interests. Ultimately, it also means that innovations are rapidly available at the national level within the individual HMOs; moreover, thanks to the competitive environment, the other healthcare organizations soon introduce similar systems. Because the HMOs are contractually tied to hospitals, laboratories, physicians, and other healthcare professionals and institutions, new systems can be implemented relatively speedily.

End users' acceptance plays a major role in the development of new digital solutions. Physicians and their professional associations often play a key digital-health role with regard to this acceptance: Without use by physicians, the systems frequently cannot function. Moreover, support by doctors can help facilitate popular trust in innovations. This role is evident in Israel just as in other countries that initiate innovation processes of this kind. The medical profession was initially skeptical and was ultimately convinced to support the development only gradually. However, unlike in some other countries where this stalled development completely, the medical community's acceptance was gained relatively quickly in Israel. One factor here was the relationship between physicians and HMOs, which simultaneously act as doctors' employers and are responsible for ensuring they are effective and able to satisfy their patients. As a result, the majority of doctors today work with electronic health records and datasets and ePrescriptions. This in turns increases the use of these applications among all other users, as well as their ultimate value. In addition, the close ties to pharmacies, laboratories and other service providers, which are generally also a part of the HMOs, have been helpful throughout the entire process, ensuring that all actors are accounted for in the digitalization process.

In addition to the HMOs' efforts to provide targeted information to their salaried physicians, an oversight system enabling doctors to compare their region's efficiency with that of other regions has provided additional motivation to implement digital applications. Treatment data is collected and aggregated for each region, and then compared to similar measures from other regions in the country; metrics of this kind can help convince physicians that the new systems are effective. While this procedure carries a very low probability that individual physicians will be publicly criticized in the form so-called doctor shaming, it does produce a healthy competition between physicians, making effective innovations attractive and inviting imitation.[496]

However, one disadvantage of the HMOs' position as initiators is that different systems are developed that may not be able to communicate with one another. For example, patients in regions without a Clalit hospital are generally forced to visit state-owned institutions that do not have the right infrastructure to retrieve patient data from Clalit. This interoperability problem is already being worked on. Thus, improvements should be evident in the future. Accordingly, communication across institutional borders currently represents the greatest challenge for healthcare-sector digitalization in Israel.

If the ministry jumps on board (regulation and strategy)

In the preceding chapters, we examined how little regulatory intervention by the Health Ministry has been needed in the past, thanks to the HMOs' high level of engagement and the free space they are accorded for independent activity. However, after numerous voices were raised calling for national data-exchange capacities, in part to improve secondary uses of the data,[497] the ministry can now play a more active role in the digitalization strategies, and jump on board with the development, so to speak.

The process now being carried out initially involves several rounds in which proposed measures are discussed with the HMOs, with the goal of coming to a joint consensus. However, if an overriding national interest exists, then the ministry will also engage in regulatory activity on its own. Nevertheless, before it resorts to actual legislative action, it will here too initially seek to steer the process through the use of guidelines. Thus, the current digital health strategy represents no more than a framework objective aimed at unifying the data exchange between the HMOs. The ministry is providing the infrastructure necessary for this task with the goal of being able to integrate all the information from the HMOs' various electronic health records. The ministry views itself as an *enabler* that provides a basic infrastructure and a framework conducive to innovation by the HMOs.

The OFEK project offers the best example of this form of development in Israel: In the early 2000s, dozens of different information systems were used in the various divisions of the healthcare institutions affiliated with Clalit, the country's biggest service provider. Faced with this fragmentation, Clalit employees increasingly demanded the simple ability to retrieve all relevant information within their own facilities. This led to the development of OFEK as an internal healthcare information network. This initially internal development was then taken up by the ministry at the national level, and is now also used by other HMOs. The national infrastructure was thus to a certain extent constructed by a private company; however, it is operated by the government, and the data is stored on a decentralized basis. Currently, a new system (EITAN) is being developed and tested based on more recent standards.

496 Interview, Israel study trip
497 Ibid.

Technology and research

In many countries, digital health systems have already been in place for many years. For example, this process was begun quite early in Israel, with the critical role to be played by ICT recognized at an early date. EMRs have existed since 1989, and EHRs since 1995. The fact that this development has taken place relatively quickly is due to the factors examined above. In the past, the HMOs have developed their own electronic health record systems and ePrescription services, with implementation following internal timetables rather than being influenced or managed by the Ministry of Health. The HMOs also entered into close cooperation with the technology industry at quite an early date. With the passage of the state's digital health plan, a third actor has also joined this interaction, primarily playing a guiding and regulating function. The national digital health strategy does not contain any provision for review of the HMOs' cost allocations. In addition to the healthcare service providers and the government, various other interests are also included in the process, including patient representatives and advisory councils. All relevant actors in the Israeli healthcare system are thus active in the planning and implementation.

In the future, it appears that Israel's medical researchers in particular will gain easy access to quite high-quality data, as the databases on which the electronic health records are based are very comprehensive and cover the entire population. However, according to some Israeli researchers, the strength of this data collection lies not solely in its comprehensiveness, but rather in the clear structure that allows targeted queries to be simply processed. Israel's goal is to position the country's actors successfully in the world digital healthcare market.[498]

498 *Israel beschließt Ausbauprogramm für digitale Gesundheit.* [online] Germany Trade & Invest offizielle Webseite. Available at: http://www.gtai.de/GTAI/Navigation/DE/Trade/Maerkte/suche,t=israel-beschliesst-ausbauprogramm-fuer-digitale-gesundheit,did=1917398.html

6.5 France

6.5.1 State of digitalization

France's efforts to digitalize have stalled in recent years. As a result, digital takeup as a whole stagnated in the country. For example, as compared to other European nations, the scope of opportunities in France to make medical appointments via online portals are very limited, and there is only moderate activity in the way of exchanging patient data and using ePrescriptions.[499] In addition, much more needs to be done in terms of using big data to develop personalized medicine. Given that a number of strategies and reforms have been adopted only recently, it is not yet possible to draw any conclusions on their impact.[500]

The current state of digitalization in France can be described as follows: the French form of the electronic health record (EHR) is called the *Dossier Médical Partagé* or DMP (prior to 2016: *Dossier Médical Personnel*) and was introduced as a pilot project by the Health Insurance Reform Act of August 2004. It was designed to keep a record of relevant patient data in an online portal. Healthcare providers were to be the primary beneficiaries of this EHR, as it would ideally give them a better overview of the patient's health. After a long pilot phase, the DMP was put into operation nationwide for the first time in 2011. The principal management of the DMP was entrusted to ASIP Santé *(Agence des Systèmes d'Information Partagés de Santé),* a national digital health agency founded in 2009. Total implementation costs for the DMP amounted to € 210 million. After roughly one and a half years, the government determined from the results of a survey that only about 160,000 patient files had been created, with roughly 90,000 of them containing no information whatsoever. Considering these numbers, the authorities halted operation of the DMP in the fall of 2012 and released ASIP Santé from its role as system operator.

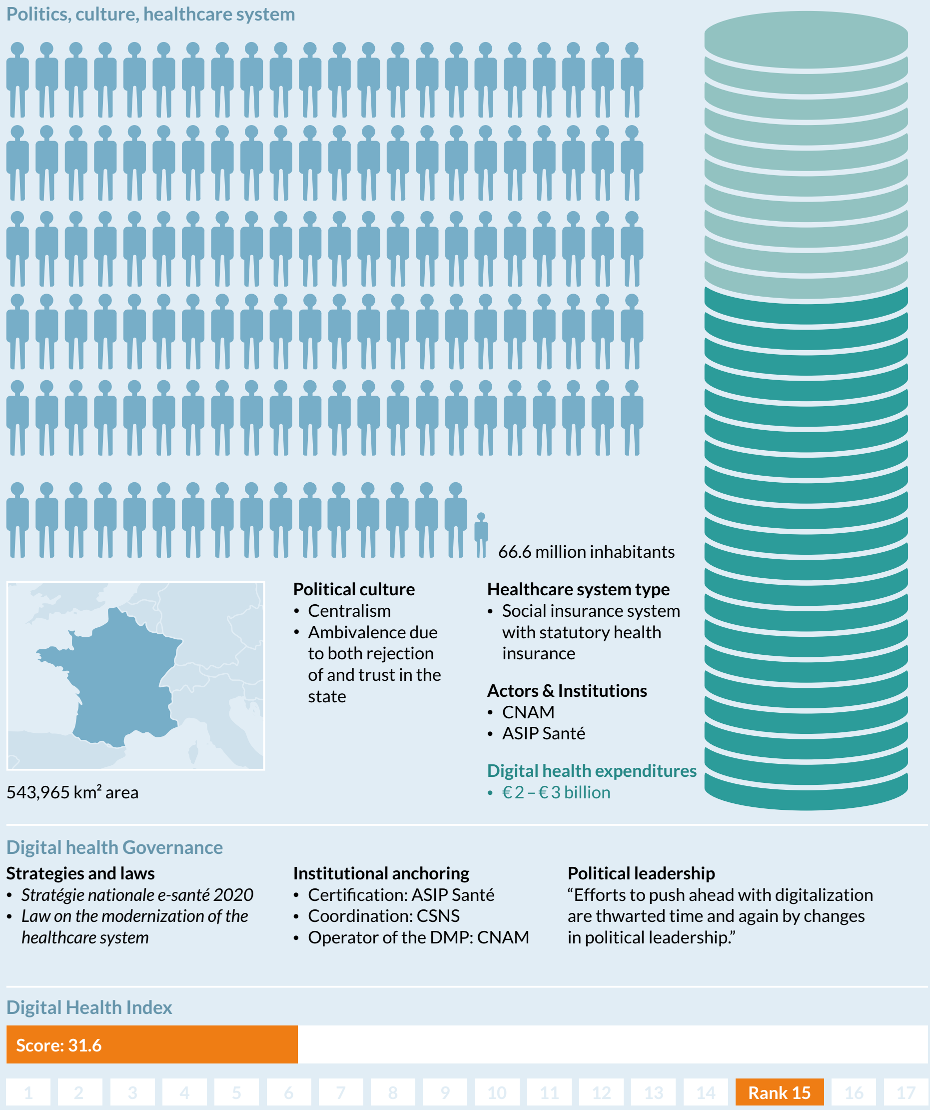
The discontinuation of the DMP was followed by a four-year phase of stagnation, during which time the system's maintenance costs alone amounted to € 35 million; indeed, the system had to be maintained despite the fact that it had been decommissioned. With the enactment of the law on the modernization of the healthcare system on 26 January 2016, operation of the DMP was resumed. As part of the relaunch, principle management of the system was entrusted to the national health insurance agency known as CNAM *(Caisse nationale d'assurance-maladie,* previously called *Caisse nationale de l'assurance maladie des travailleurs salariés* (CNAMTS)). In addition to the name change from *Dossier Médical Personnel* to *Dossier Médical Partagé,* there were other major changes, and usage was improved by designing it in a way that was easier and more intuitive for users.

Prior to its relaunch, the DMP had provided no added value, due to the fact that a large number of its files were completely empty. These files were the result of patients creating an account for themselves, only to then find it too complicated to use. The empty files were also the result of the fact that only few physicians were able to use the DMP in a proper manner and actually fill the files with data. The new law now makes it compulsory for healthcare providers to create a DMP for every patient and update these on a regular basis.

499 European Commission (2016). *Digital Agenda Key Indicators.* [online] Available at: https://digital-agenda-data.eu/datasets/digital_agenda_scoreboard_key_indicators/visualizations

500 Christ, C. Frankenberger, R. (2016). Auf dem Weg zu Wohlfahrt 4.0 – Digitalisierung in Frankreich. *Politik für Europa – 2017 plus.* Friedrich-Ebert-Stiftung. Bonn.

FIGURE 60: **Country profile France**



Source: Bertelsmann Stiftung

The change of the principal management body to CNAM has resulted in improved use of the DMP, in part thanks to a considerable increase in additional usable data. Among other things, the full history of reimbursements from the health insurance fund is automatically taken up in a new joint patient file. This also means that it is no longer possible to generate an empty file, that is, unless the patient refuses a *Digital Signal Processor* (DSP). When physicians are able to look at a DSP during a consultation, it decreases the threat of lost time; in turn, this leads a higher acceptance among physicians.

According to the president of the physicians' union known as the *Confédération des Syndicats Médicaux Français* (CSMF), the reason for the low number of users was the system's lack of user-friendliness. For example, he noted that it was too complicated for users to upload information and documents to the DMP. The physicians' union blames this on the developers: "It was designed by a computer scientist who didn't know much about how medical practices work."[501]

The DMP is currently in a new pilot phase. According to the director-general of the CNAM, the DMP is scheduled to begin operation on a national level by October 2018.[502] Statistics show that the re-commissioning of the DMP has already produced some initial successes. For example, in April 2017, roughly 10,000 new DMPs were being created each week.[503] The current status of the pilot project for the relaunch of the DMP suggests that about 260,000 accounts were created between early 2017 and October 2017. The director-general has argued that the goal of the new DMP is to make the system "as simple as possible" and to "give patients principle responsibility for their accounts." The pilot phase will also be used to conceive other goals so as to avoid a repetition of the failure of 2012. In particular, priority will be given to security and user-friendliness. The idea is to enable access to DMPs via smartphone as well. Yet another goal is the introduction of ePrescriptions. Also on the agenda is the introduction of QR Codes for prescriptions, which can then be scanned and read by pharmacists.[504]

Also planned is the introduction of a digital version of the health insurance card known as the *Carte Vitale.* The *eCarte d'assurance maladie* is set to be tested for visits to physicians for a period of one year. The CNAM has stated its intention of using the *eCarte Vitale* to experiment with a new form of secure identification, authentification and patient signature via smartphones. In the medium term, it is designed to function as a supplementary solution to the physical *Carte Vitale.*

The administration of the sante.fr website by France's Ministry for Solidarity and Health is part of the law on the modernization of the healthcare system introduced in January 2016 (see above). sante.fr is set to serve as a state-run health information portal that provides general information about illnesses and health, but also access to data on healthcare facilities and professionals in the healthcare system. A pilot project that offered a search-and-find function for physicians and facilities was in operation in the Paris region up until September 2017 and is currently being expanded. The intention is to roll out the health portal throughout France in the first half of 2019.

Unlike sante.fr, the portal known as ameli.fr – which has roughly 25 million user accounts and is the most widely consulted health portal in France – is financed and operated by CNAM. The portal primarily covers questions of reimbursement and billing. Beyond accessing their accounts, users can also call up a database of healthcare providers. This makes it possible for users to look up information such as the address and fields of specialization of providers, their average costs and the amount reimbursed by health insurance funds.

501 Godeluck, S. (2017). *Le dossier médical partagé va enfin prendre son envol. LesEchos.fr.* [online] Available at: https://www.lesechos.fr/economie-france/social/0301297278476-le-dossier-medical-partage-va-enfin-prendre-son-envol-2153701.php [Accessed 30 April 2018].

502 ticsante.com (2018). *Nicolas Revel annonce la généralisation du DMP pour octobre 2018.* [online] Available at: https://www.ticsante.com/Nicolas-Revel-annonce-la-generalisation-du-DMP-pour-octobre-2018-NS_3918.html.

503 Cour des comptes (2018). Rapport public annuel 2018, Les services publics numériques en santé: des avancées à amplifier, une cohérence à organiser, Tome II, p.215-239.

504 ticsante.com (2017). *Près de 260.000 DMP créés depuis le début de l'année 2017.* [online] Available at: https://www.ticsante.com/print_story.php?story=3735.

6.5.2 Structures and characteristics

Country characteristics

France has 66.6 million inhabitants living on a 543,965 km² area. The nation's political system is based on the constitution of the Fifth Republic, which provides for a democratic republic, a strong two-tiered executive and a semi-presidential government system with a bi-cameral parliament. The president determines the direction of policy, while the prime minister – who is appointed by the president – acts as a connective link to the parliamentary majority. In general, the political system is set up in such a way that the president and head of government as well as the parliamentary majority come from the same political camp, even though the elections for president and parliament are separate.[505] When the parliamentary majority is in opposition to the president, it is called *cohabitation.* In phases of *cohabitation,* the president is severely restricted in his competencies and dependent upon close cooperation with the government and the parliamentary majority that supports it. There are a larger number of politically relevant yet highly fragmented political parties.[506]

France's administration is that of a decentralized unitary state. Historically, centralism has been considered to be an element of governance and modernization in France. However, in recent years, a process of decentralization has introduced four administrative levels. In other words, the country has seen the transfer of regulatory competencies and more autonomous decision-making powers. Today, there are four administrative levels of government: central government, regions, so-called *départements* and municipalities. While separate spheres of responsibility exist in theory, in practice, these spheres are compromised due to overlaps and cross-financing.[507] For example, regions are responsible for planning and implementing regional / local public healthcare policy; however, at the same time, roughly two-thirds of hospital beds are managed by municipal authorities.[508]

France ranks 24th on the NRI, putting it in last place among the countries surveyed. This poor showing indicates that the political and technical conditions necessary to be able to capitalize on emerging information and communication technologies and opportunities for

TABLE 45: **Networked Readiness Index 2016**

	Rank 2015		Rank 2016
Netherlands	4	↓	6
Switzerland	6	↓	7
Denmark	15	↑	11
Germany	13	↓	15
Israel	21	→	21
France	26	↑	**24**

Source: Bertelsmann Stiftung

505 Vogel, Wolfgang (2005). Frankreich. *Charakteristika des politischen Systems.* [online] Bundeszentrale für politische Bildung. Available at: http://www.bpb.de/izpb/9130/charakteristika-des-politischen-systems?p=all
506 Ibid.
507 Gey, P und Schreiber, B. (2014). Frankreich: Wird der Staat jetzt umgebaut? Gebietskörperschaften auf dem Prüfstand. [pdf] Friedrich-Ebert-Stiftung. Available at: http://library.fes.de/pdf-files/id/10525.pdf
508 Schölkopf, M. und Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.

digital transformation are not as pronounced as they are in the other countries surveyed. With regard to digital health, the findings of the NRI underline the experiences gained.

Political culture

France's political culture is characterized by strong oppositional boundaries between left and right, a highly fractional party system, a wide diversity of cultural, religious and political opinions among the population and a high level of conflict-readiness. Associations, trade unions and other interest groups are considered to be relatively weak; at the same time, the relationship between the state and its citizens is defined by an ambivalent mixture of citizens' need to both reject and place one's trust in the state. The republic and the nation are seen as a bond that should serve to create a unity and identity out of this diversity.[509]

France's high conflict potential, in particular, influences the effectiveness of its politics. While parties are often forced to enter into alliances due to the electoral system of absolute majority voting, the process also reinforces the formation of two political blocs. This leads to a further strengthening of the traditionally strong left-right opposition.[510] As a result, in many cases, a newly elected government will reverse the reforms made by the previous government and / or carry out new and sometimes contradictory reforms. This is precisely where progress in the realm of digitalization suffers, as new governments repeatedly introduce new regulations and / or reverse existing ones.

Concerns regarding data privacy play a relatively subordinate role in the digitalization of the French healthcare system. At the moment, the CNAM is currently feeding the DMP with the billing data of all insured persons so as to fill the personal EHRs. A similar approach can be observed in Germany in the EHR projects undertaken by the TK and AOK. In Germany, however, a national mirroring of the data of insured individuals as part of statutory health insurance into a central EHR would most likely lead to public debates, which have not been observed to have taken place in France. Trust in data protection at medical and healthcare facilities associated with the healthcare system is at a level comparable with that of the Netherlands and higher than in Germany. There were no promoting or inhibiting influences detected here.

TABLE 46: **Trust in medical facilities and health care facilities – France**

	Overall "Trust"	Overall "Do not trust"
EU-28	74 %	24 %
Denmark	89 %	10 %
Germany	77 %	21 %
France	**79 %**	**17 %**
Netherlands	81 %	18 %

Source: TNS Opinion & Social, DG JUST und DG COMM (2015). Special Eurobarometer 431 – Data Protection. European Commission, Brüssel.

509 Vogel, Wolfgang (2005). *Charakteristika des politischen Systems.* [online] Bundeszentrale für politische Bildung. Available at: http://www.bpb.de/izpb/9130/charakteristika-des-politischen-systems?p=all
510 Ibid.

Type of healthcare system

The structure of the French healthcare system is based on the concept of social insurance (Bismarck), and its goals of universality and solidarity have led to an increasingly national approach (Beveridge). Since 2000, statutory health insurance has been obligatory for the entire population. The primary criterion for insurance is gainful employment, while non-working family members are co-insured. Statutory health insurance is financed by a number of sources: social security contributions, a tax-like charge *(contribution sociale généralisée/maladie)* and other earmarked taxes (e.g., 15 % on car insurance premiums, a portion of alcohol and tobacco taxes). Seeing as 30 percent of the costs of medical treatment are usually borne by the patients themselves, private insurances are highly important as a form of complimentary protection.[511] In 2017, the state financed the healthcare system by means of 11.5 percent of its GDP.[512]

The social insurance system is divided into local, regional and national bodies of the various insurance areas that are administered on an equal basis. However, *the assurance maladie,* which is administered by the umbrella organization UNCAM *(Union nationale des caisses d'assurance-maladie),* is only able to fulfill its tasks in cooperation with state actors and under the supervision of the state. The introduction of statutory insurance in France in 2000 comprised the entire population. The reform law known as *Hôpital, Patient, santé et territoires (Loi HPST)* of 22 July 2009, established individual health agencies – the so-called ARS *(Agences régionale de santé)* – for each French region. Their task is to plan and prepare healthcare supply needs and strategic healthcare plans at a regional level. The ARS are also required to implement national health-policy decisions made by the Ministry for Solidarity and Health and to adapt them to fit their regions. In the context of the French healthcare system as a whole, however, regional actors play only a subordinate role. The precise principles of regulation are set down in the constitution of the Fifth Republic.[513]

In France, the focus in terms of physicians is on general practitioners and specialists. In international comparison, France has an above-average number of general practitioners and specialized physicians. However, despite that large number, there are still bottlenecks in some rural areas, while in other regions, such as in Paris and the south of France, there is an oversupply of physicians. Since the Health Insurance Reform Act of 13 August 2004, all insured individuals are obliged to choose a general practitioner *(Médecin traitant).* The gatekeeper function of the general practitioner is ensured by law insofar as the fee for seeing a specialist is reduced from € 5 to € 1 if the consultation is the result of a referral by a general practitioner.[514]

The care, financing and organization of the healthcare system in France are centrally regulated by the state and statutory health insurance. Since the 1990s, statutory health insurance has been increasingly included in regulatory activities.[515]

511 Schölkopf, M. und Pressel, H. (2014). *Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik.* 2nd ed. Berlin: Medizinisch wissenschaftliche Verlagsgesellschaft.
512 OECD: https://data.oecd.org/healthres/health-spending.htm
513 Reiter, R. (2014). Regulierung des Gesundheitswesens. *Gesundheitspolitik Frankreich.* [online] Available at: http://www.bpb.de/politik/innenpolitik/gesundheitspolitik/177384/regulierung
514 Reiter, R. (2014). Regulierung des Gesundheitswesens. *Gesundheitspolitik Frankreich.* [online] Available at: http://www.bpb.de/politik/innenpolitik/gesundheitspolitik/177384/regulierung
515 Reiter, R. (2014). Regulierung des Gesundheitswesens. *Gesundheitspolitik Frankreich.* [online] Available at: http://www.bpb.de/politik/innenpolitik/gesundheitspolitik/177384/regulierung

Digital health expenditures

Expenditures in the area of IT in France's healthcare system are estimated to be around € 2 to € 3 billion, which is roughly 1 percent of the country's total healthcare expenditures. In terms of digital health spending, roughly € 80 to € 140 million is spent on the further development of telemedicine. The largest single expenditure is the development of the DMP, which accounts for roughly € 210 million and which had maintenance costs of an additional € 35 million to date, even though the DMP was non-operational for a long time. And, finally, the implementation of *"Le programme Territoire de Soins Numérique"* costs a total of € 80 million.[516]

Actors and institutions

The French healthcare system is very complex, with a variety of actors playing a role in a wide range of fields. The following provides a brief introduction to the main stakeholders in the area of digital health:

France's Ministry for Solidarity and Health *(Ministère des solidarités et de la Santé)* is the central administrative body and simultaneously the most important actor in the country's healthcare system. It is responsible for framework legislation in the areas of general social insurance, statutory health insurance, outpatient and inpatient care and services, as well as in the field of public health.

The CNAM is the central national health insurer and also a national public administrative body with its own legal personality and financial autonomy. It is subject to the ministry in charge of social security and the Ministry of Economy and Finance. CNAM is responsible for regulating health policy together with France's health ministry. CNAM is also the body responsible for the health portal ameli.fr and has been in charge of the DMP electronic patient file since the 2016 modernization act.

UNCAM *(Union nationale des caisses d'assurance-maladie)* defines itself as the umbrella organization for statutory health insurance funds. It comprises the CNAM, the MSA *(Mutualité sociale agricole)*, which insures workers in the agricultural sector, and the *RSI (Régime sociale des indépendant* (RSI)). UNCAM emerged as part of the Health Insurance Reform Act of 2004. Its task is to cooperate in the political management of the public health sector in determining services and reimbursement rates. The director-general of UNCAM is simultaneously director-general of CNAM.[517]

The regional health authorities known as ARS *(Agence régionale de santé)* are based in each region and bring together different health-related administrative bodies with other actors drawn from the fields of health and social welfare. The implementation of the ARS was realized by the *Loi HPST* in 2009. Its task is to oversee the planning of the supply requirements and the regionally adapted implementation of national health-policy decisions and guidelines.

ASIP Santé is the national agency for digital health. It is responsible for advancing digital health and the implementation of national digitalization projects. It was founded in 2009

516 Cirre, P. (2015). *e-Health: strategy and ongoing programs.* [online] Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/ev_20151123_co06_en.pdf

517 Reiter, R. (2014). Regulierung des Gesundheitswesens. *Gesundheitspolitik Frankreich.* [online] Available at: http://www.bpb.de/politik/innenpolitik/gesundheitspolitik/177384/regulierung.

as a result of efforts by France's Ministry for Solidarity and Health to decisively foster the development of a digital health information system. Based on several reports issued in 2007 and 2008, they had determined that the inability to achieve any advancement was due to a lack of strategic management. The founding of ASIP Santé was designed to work against this trend, for example, by taking on particular tasks, such as the development of interoperability. In 2011, ASIP Santé was given responsibility for the realization of the DMP electronic patient card. However, due to a lack of positive results, ASIP Santé was relieved of this responsibility in the fall of 2012. The DMP was subsequently shut down for four years, before being taken over by CNAM in 2016.[518]

eHealth France Alliance is a private organization consisting of four professional associations that represent companies offering eHealth solutions. It was founded in October 2015 with the goal of raising public awareness for the digital health sector and thus creating more jobs. Ultimately, the aim was to continue the overall modernization of the healthcare system.[519]

6.5.3 Digital health governance

Strategies and laws

France's first and latest national strategy for the digitalization of the healthcare sector – the *Stratégie nationale e-santé 2020* – was only adopted in 2016. It focuses on big data and telemedicine services in an attempt to improve the cost-efficiency of the healthcare system and the decision-making capacity of physicians. The four-pillar strategy places the following items on the national agenda: big data as a key form of support in treatment and care, closer collaboration between actors, innovation incentives, the reduction of bureaucratic hurdles, the development of telemedicine for more easier access to medical care and information security. The primary goal of these emphases is to foster an increase in health literacy among the French population. The idea is to get the French population to question diagnoses and avail themselves of information online via diverse health information portals (e.g., sante.fr). In order to be able to successfully implement digital health solutions, the strategy also foresees the development of a standardized system of terminology. This digital health strategy was created by France's Ministry for Solidarity and Health and encapsulates a list of goals to be achieved by 2020.

The laws enacted as part of this strategy are designed to create the necessary framework for regions to be able to decide themselves what kind of services and applications should be implemented on a regional basis. In this context, digital health is not seen as being adjunct to general healthcare provision, but instead as an integral part of it.

In addition, there is a national plan that has been in place for years and operated by the ASIP Santé that foresees the introduction of EHRs and ePrescriptions. These programs were put on hold for several years under the government of former president Hollande, only to be revived in 2016 and passed on to CNAM. The current plans also foresee patient portals and telemedicine applications, but not, however, mHealth or the use of big data in the area of health.[520]

518 Interview, Studienreise Frankreich.
519 ehealthfrance.com, (o.J.). eHealth France Alliance Offizielle Webseite. [online] Available at: http://ehealthfrance.com/
520 Interview, Studienreise Frankreich.

Step-by-step pilot testing and project evaluations are now being carried out by the regions. Implementation plans with corresponding timeframes were defined in the case of the relaunch of the DMP in 2016, but also for the introduction of regional ePrescription and telemedicine services and for the further development of the health information portal santé.fr. However, no legally binding deadlines are as yet in place.[521]

The law on the modernization of the health system (2016) aims to make France's health-care system fairer and more efficient through the use of various innovations. It seeks to address three fundamental problems, in particular: the aging population, the rise in chronic illness and the unfair aspects of the French insurance system. The law is based on the following four pillars:

- Fostering prevention and health promotion
- Facilitating patient pathways
- Innovations for a sustainable healthcare system
- Strengthening public administrative bodies

The law is a key factor in the digitalization of France's healthcare system because it foresees, among other things, bringing the public health information service under the auspices of the Minister for Solidarity and Health. This health information service will also be responsible for the development of the sante.fr health portal. In addition, the transfer of the DMP to the CNAM was carried out by means of this law. It also requires that health-care providers now upload patient health information to the DMP. With regard to the issue of interoperability, the law aims to introduce and establish security and interoperability standards.

Telemedicine is an integral part of the new bill on social security funding of 2018, and many are hoping that authorities will move past the discussion stage to actual implanta-

TABLE 47: **France's digital health timeline**

Year	Strategy / Draft legislation
2004	Health Insurance Reform Act *La réforme de l'Assurance Maladie*
2004	Establishment of the DMP
2005	*Plan Hôpital 2007*
2009	Reform law *Hôpital, Patient, santé et territoires (Loi HPST)*
2009	Establishment of *ASIP Santé*
2012	Suspension of the DMP
2013	*Le programme Territoire de Soins Numérique – TSN*
2014	*Réforme territoriale:* reduction in regions from 22 to 13 (took effect in 2016)
2016	*Stratégie nationale e-santé 2020* (nationale digital health strategy)
2016	Law on the modernization of the healthcare system
2016	Re-introduction of the DMP
2018	*Loi de financement de la sécurité sociale 2018*

Source: Bertelsmann Stiftung

521 Ibid.

tion. Of particular importance are the accurate determination of the financing framework and the organization of care. It is now the task of actors working in the healthcare sector to take the necessary initiatives to reach these goals.

Institutional anchoring

Although France indeed spends a comparatively large amount of money on digital health, with its current strategy, it still does not have a budget concretely dedicated to the purpose of meeting its goals. Also missing is any regulation and introduction of support measures for innovative mobile applications. The ASIP Santé is a digital health agency whose mission is to create conditions for digital health. These include the setting of security and interoperability standards as well as the development of standards for the integration into the existing commercial digital services.

Ultimately, ASIP Santé has relatively little authority to enforce its policies. The interoperability framework developed by ASIP Santé and the guidelines contained therein – including those with regard to semantic standards – can only become obligatory for providers and services if an enforcement order from the health ministry stipulates this to be the case. At the suggestion of ASIP Santé, this can be undertaken for individual guidelines and standards, but never for several guidelines at the same time. The data in the DMP can be used for health research purposes. To date, few organizations and educational institutions have offered education and training programs on how to administer and benefit from digital health programs.

The interoperability standards validated by ASIP Santé by means of certifications now form a national interoperability framework developed and managed together with actors drawn from the healthcare sector and industry.

The strategic Committee for Digital Health (CSNS) was founded in 2017. Its role as the coordinating body is to bring industry actors, health professionals, healthcare organizations, patient associations and ministries together at one table and to guarantee and harmonize the implementation of the national digital health strategy in four project groups.

National funding programs, such as *Le programme Territoire de Soins Numérique* (TSN), support the implementation of innovative technologies in the realm of communication between healthcare service providers in the regions. The CNAM also uses parts of its budget to develop, reimburse and introduce its digital health services. For example, there are defined service goals for the introduction of the new DMP and the associated digitalization of patient records; however, non-compliance with these goals does not result in any fines imposed by public authorities.

In the legal realm, the patient data protection act was expanded in recent years and new regulations introduced between organizations with regard to the exchange and archiving of patient data via the DMP. Corresponding laws now determine the rights patients have with regard to their health records and the obligations doctors are required to fulfill. The liability of physicians in the case of errors in treatment in the context of medical products and EHRs is not specified more precisely by law.

Political leadership

France's strong left-right opposition and fragmented party landscape often lead to pronounced shifts in policy from government to government, which also impact the realm of digital health. Political leadership in the French healthcare system is heavily dependent on each respective minister in charge. Although attempts are made time and again to push ahead with digitalization, innovation is hampered due to the country's central organization and the heavy impact of policy changes that occur when political priorities shift as a result of changeovers in power. The DMP began operating nationwide in 2011, but was discontinued under the new government in 2012 for cost reasons. Two years later, the decision was made to transfer the DMP to the CNAM, and this, in turn, was only carried out two years later. Since the new government came to power in 2017, digitalization is once again being intensified in many areas, and this is also noticeable in the digital health sector. Overall, however, the subject of digital health has not played a role in election campaigns and is not a driving force in the current administration.[522]

While questions regarding the healthcare system were indeed politically relevant in the run-up to the 2017 presidential elections, they revolved around quite basic issues, among others on cost savings, cuts to insurance benefits and a return from the principle of non-cash benefits to the principle of reimbursement.[523] Still, now-President Macron was the candidate with the most vocal support for the modernization and digitalization of the health care sector in his election program. He focused in particular on the promotion of telemedicine without, however, seeking to change the existing system in any comprehensive way.[524]

The Ministry for Solidarity and Health also recognized that France was scoring poorly in terms of digitalization of the healthcare system in international comparison. In 2018, the current head of that ministry, Agnès Buzynin, spoke of the "necessity" to establish "a rapid strategy for the advancement of the digital revolution in the healthcare system."[525] In addition to the French president and the minister for solidarity and health, the government commissioner for digital issues has also already made positive public comments regarding developments in the realm of healthcare. For example, in the coming years, he intends to provide financial support to startup companies seeking to become active in digitalization in the healthcare sector, among others.[526]

522 Interview, Studienreise Frankreich.
523 De Bousingen, D. (2017). *Der schwierige Start for Hoffnungsträger Macron.* [online] Ärzte Zeitung. Available at: https://www.aerztezeitung.de/politik_gesellschaft/gesundheitspolitik_international/article/935708/machtwechsel-Elysee-schwieriger-start-macron.html
524 De Bousingen, D. (2017). *Gesundheitssystem vor radikalen Änderungen?* [online] Ärzte Zeitung. Availble at: https://www.aerztezeitung.de/politik_gesellschaft/gesundheitspolitik_international/article/934072/wahlen-frankreich-gesundheitssystem-radikalen-aenderungen.html
525 Weinberg, M. (2018). *How e-health enters into the life of French people.* [online] Verlingue. Available at: https://www.verlingue.com/how-e-health-enters-into-the-lives-of-french-people/
526 Dillet, R. (2018). *France's Digital Minister Mounir Mahjoubi on upcoming digital policies.* [online] TechCrunch. Available at: https://techcrunch.com/2018/01/30/frances-digital-minister-mounir-mahjoubi-on-upcoming-digital-policies/?guccounter=1

6.5.4 Impact analysis

The following is an explanation of the observed influence of different variables on the digitalization process in France.

The following observations were made regarding the individual variables:

The information provided was once again presented in the form of figure 61. This graph shows the observations made here in the form of highly negative (dark orange) to highly positive bars (dark green). The graph below describes the expected effects of the individual indicators described above on the level of digitalization. After that, a number of individual variables and their mode of action for digitalization are highlighted and elaborated upon.

The following observations were made regarding individual variables:

Country and population size: As the largest country among the surveyed countries and the worst ranking, the geographic size of the country has a negative effect. Observed effect: −

State and government form: The state and government form shows no observable effect on digitalization, though the strength of the executive can have a negative impact (see Commitment and involvement). Observed effect: 0

Political order: Centralism vs. federalism and subsidiarity: As a highly centralized state, France shows no effects in terms of federalist structures. Observed effect: 0

Corporatism (degree of self-government): The large number of self-governing bodies in France makes it nearly impossible to coordinate steps to be taken forward. Observed effect: −

Compromise and consensus: The presence of deep ideological divisions make compromise in France very difficult. The country's system of cohabitation often results in a political stalemate leading nowhere. As a result, no positive effect on digitalization was observed in this regard. Observed effect: 0

Role and cultural embeddedness of data-privacy protections: No concrete effects on data privacy were observed here. Observed effect: 0

Financing system: Social-insurance system (Bismarck) vs. state-run health service (Beveridge) vs. hybrid system: Given insurance provider's financial interests, short-term profits often take priority over new long-term and sometimes expensive efforts that could advance digitalization. No real effect can be observed in this regard. Observed effect: 0

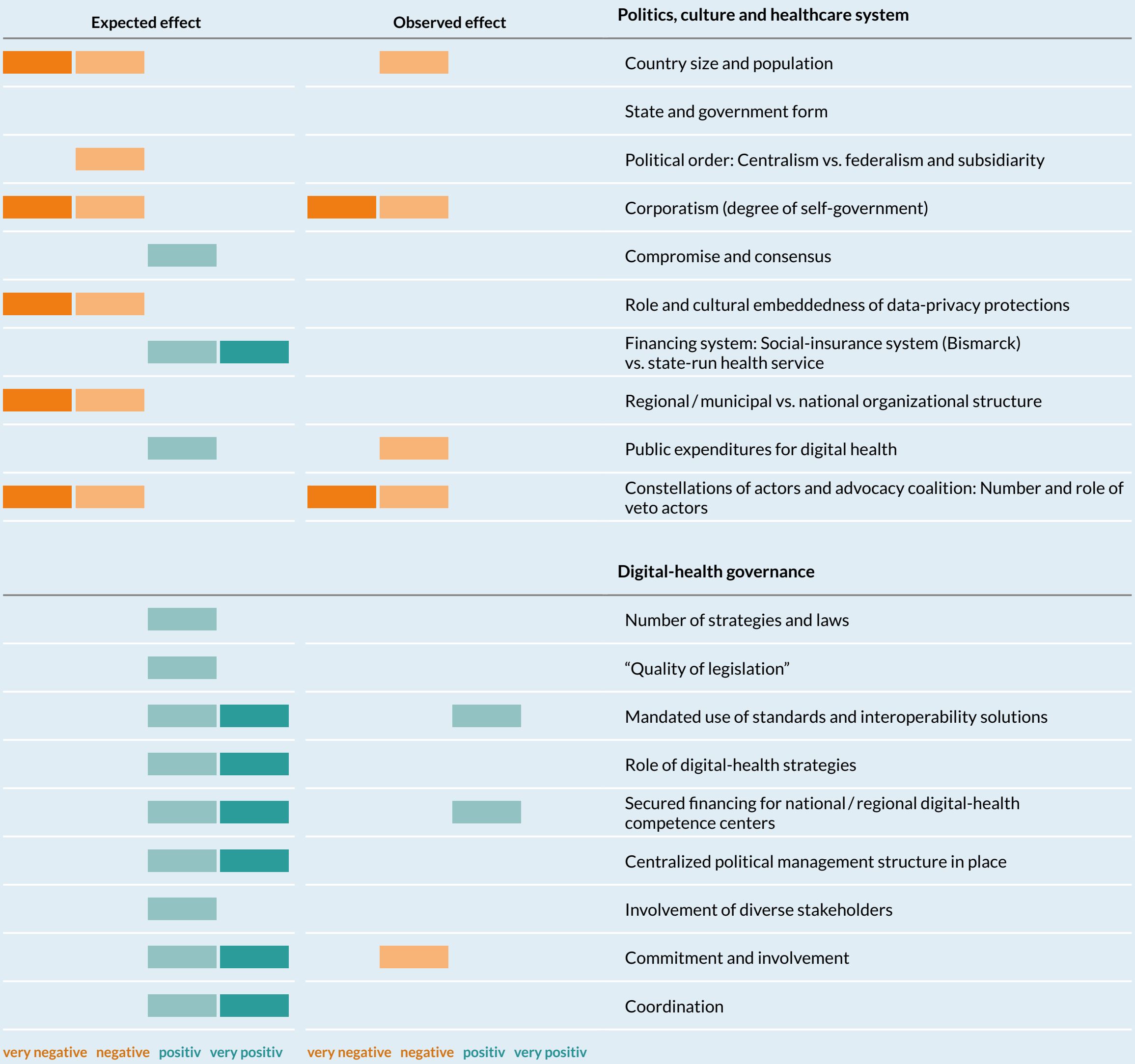
Regional / municipal vs. national organizational structure: The regions vary in terms of how far they've advanced digital transformation; no benefits have thus far been observed. This variable shows no observable effects on digitalization. Observed effect: 0

Public expenditures for digital health issues: Compared to the vast amounts of funding France has invested into eHealth, spending on digitalization is extremely limited. However, high spending levels do not necessarily lead to a successful digital transformation. Observed effect: −

Actor constellations and advocacy coalitions: Given the large number of veto actors in France, this variable has, as expected, a clearly negative impact on digitalization. There are simply too many special interests within the system for a consensus to be forged. Observed effect: −

Number of strategies and laws: Though several laws have been introduced, very little has been achieved. It should be noted that France has no genuine eHealth law in and of itself, the issue is

FIGURE 61: **Expected vs. observed effect of influencing variables on the state of digitalization – France**



Source: Bertelsmann Stiftung

simply added on to other legislation in an ad hoc manner. To date, no clear strategy has been observed. Observed effect: 0

Quality of legislation: An abundance of complex and overly-specific legislation effectively hinders digitalization. And given that no qualitatively effective laws have been passed, they have no outcome. Observed effect: 0

Binding application of standards and interoperability solutions: ASIP standards are binding. However, because they are rarely implemented, only slightly positive effect for this variable is observed. Observed effect: +

Role of digital health strategies: The absence of specific strategies and the frequent changes in political leadership results in rudderless leadership, which ultimately has a negative effect on digitalization. The absence of strategies results in no evaluation. Observed effect: 0

Secured financing for national / regional digital-health competence centers: ASIP enjoys adequate financing, which allows it to move forward in developing standards. Observed effect: +

Central political management installed: Despite France's centralized political system, no form of centralized political management for digitalization has been established. Instead, responsibility for this has been passed on to health insurance providers. Observed effect: 0

Involvement of diverse stakeholders: The centralized development of standards without the involvement of physicians and other users has resulted in a stop-and-go process. Observed effect: 0

Commitment and involvement: Due to changing governments and the shifts in policy interests this involves, many projects have been terminated for political reasons and then taken up or re-launched, only to be reversed by the next administration. This variable has a more negative effect on digitalization in France. Observed effect: –

Coordination: There have been virtually no coordinated policy measures taken that have had a positive impact on digitalization in France. Observed effect: 0

Too many actors, too little coordination and cooperation

France's healthcare system comprises a multitude of actors operating at different levels, and especially in the realm of digital health there is little coordination and cooperation among them. In principle, many things in France are regulated centrally; however, a national rollout of a digital infrastructure does not appear possible to date. The reason for this lies not only in the landscape of multiple actors, but also in the lack of coordination and cooperation. The CSNS, which is designed to bring the different stakeholders together, has only been in place since 2017. At the same time, attempts have been made to roll out the centrally developed national infrastructure in regional pilot projects; this, however, has been far from compatible in all regions.

Lack of user involvement

The lack of coordination with individual regions points to another problem in France's approach to digital health, namely the insufficient or complete lack of user participation. In the initial pilot projects, data within the system was inadequate, which led to many physicians very quickly doubting the overall benefits and losing any interest in sharing data. The lack of involvement on the part of physicians ultimately resulted in many stakeholders adopting a negative attitude, especially because the system had shown no tangible benefits by that point. By transferring it to the CNAM, the supporting participants are now hoping for more data from the very start. However, it remains doubtful whether a larger amount of data will be able to obscure the weaknesses of an application that was not designed and/or harmonized together with end users.

Simply replacing laws is not a constructive strategy

France has shown that a lack of clear strategies and framework objectives has a negative impact on progress. In contrast to countries such as Switzerland and Denmark, France indeed has a strategy in place, but it does not have the substantive visions and goals or even budget allocations to achieve it. In comparison with Israel – a country that also had no strategy for a long period of time –, France introduced strong legal regulations, instead of first allowing different actors to operate and then integrating them more actively in the design process. In this case, it was observed that a large number of laws does not automatically denote progress. It would appear that a consistent strategy that incorporates all the important and necessary stakeholders, digitalization targets and timeframes is more expedient than merely passing laws on a regular basis, which can lead to either rapid changes in course or devalue the progress already made in realm of digitalization.

Changes of government as stops on innovation

In France, the political system and the prevailing political culture are two important variables in the digitalization of the healthcare system. In this sphere, the study showed the extent to which strong oppositional stances in connection with political power shifts can have a negative impact on innovation. Changes in government bring existing programs to a halt on a regular basis, as was the case with the progress of the DMP. It often takes years before a different, similar or even the exact same program is taken up again, and this process acts as a hindrance to innovation and makes digitalization efforts that much harder, even setting them back years.

Progress through privatization and the handing-over of EHRs to insurers

In addition to the DMP, France also has a so-called DP, the *Dossier Pharmaceutique*, a file used solely for the purposes of patient medication. The DP was organized privately by French pharmacist organizations and given the legal go-ahead for nationwide introduction in 2008. In terms of its distribution and use, the DP is much further developed than the DMP. By 2016, roughly 30,000 different pharmacies and healthcare facilities had registered in the system. With 32 million active DP files, it is far more successful than the DMP. Its less complicated technical infrastructure might be a factor here; ultimately, however, it is a privately organized project with few stakeholders, which means that its implementation and use was able to progress at a much faster pace than the DMP. And yet, the example of the DP shows that digitalization can take place at different levels.

Hopes for progress are being pinned on the transfer of the DMP to the insurer CNAM. With the additional help of its existing administrative infrastructure at the regional and local levels, there are two reasons why CNAM is in a position to fill the DMP with data at a faster pace: first, the DMP can be distributed more quickly among local providers and, second, the billing data of all patients can be fed into the system, thereby achieving an added benefit. However, it remains to be seen how a solution that received little acknowledgment until now will be able to prevail in the long term.

Part III:

Analysis and Transferability

7 Lessons learned and transfer analysis

This chapter draws on the previous two sections of this report and presents a comparative analysis of the study's results. Bearing in mind the extent to which each surveyed country is comparable to the German context, we offer a series of recommendations for action at the end of the chapter.

Taking both the state of the German healthcare system into account as well as the data for each country compiled and analyzed in this report, we also provide answers to the following questions: Is the state of healthcare digitalization in Germany on par with levels observed in other, comparable countries? If not, what accounts for this? How can digitalization in Germany be fostered and expedited?

7.1 Country analysis summaries

7.1.1 Salient national characteristics in terms of strategy, readiness and data exchange

Part I of this report focused on 17 EU and OECD countries and the state of healthcare digitalization in each. Supported by a survey of international experts and intensive desktop and material research, the landscape of digital health in each country reviewed was developed in terms of a Digital Health Index and other sub-indices. This process yielded valuable information regarding both successful and unsuccessful developments.

In the following, the findings for each of the 17 countries are summarized and information regarding particularly unique developments, successes or barriers to progress are highlighted. Particularly noteworthy features and observations from Part 1 of the report are also discussed. In addition, the following discusses the conclusions that can be drawn – particularly with regard to policy objectives in Germany – from these findings.

Australia

Over a several years' period, renowned technical specialists and IT experts planned for the digital transformation of Australia's healthcare system. Early on, planners focused on uniform standards and systemic interoperability, which allowed for the development of detailed strategic roadmaps. Despite the extent of these efforts, very little in concrete terms has been achieved. The process was designed to begin with the creation of a proper architecture and followed by the introduction of a broader technical implementation. However,

NB: The sequence of country chapters is arranged according to country names in German.

planning errors were not noticed until the implementation phase had begun. A number of procedural overhauls and restructuring phases delayed and complicated the national rollout. It became impossible to proceed step-by-step and the complex, extensive nature of top-down planning has made it very difficult to make changes to the system and infrastructure when needed.

Belgium

Having abandoned a centralized approach to digitalization, Belgium has instead focused on establishing regional data hubs that allow health data to be located via metadata. A highly successful exchange standard – KMEHR – has been developed and is mandatory for all systems in the country. Instead of creating a centralized national data repository, Belgium has established hubs through which data can be accessed in their original repositories (hospitals, practices). Access is provided via a mirrored reference index, that is, the data is not actively exchanged but only read.

Denmark

Interoperability problems for direct data exchange between individual care sectors are "bypassed" by installing switching points: The Danish Shared Medication Record was designed for integration with systems in both outpatient and inpatient sectors. Although outpatient physicians cannot communicate directly with the E-Journal database at a hospital, physicians and patients can access it using the centralized health information portal sundhed.dk.

Estonia

Estonia's healthcare system is just one of many areas that underwent a digitalization process after the fall of communism. Given the country's size, such campaigns have always had an impact on the entire population and have proven very effective. The cost of developing and launching Estonia's EHR totaled just €10 per capita.

France

The failure of the DMP can be attributed to its lack of uptake among the population and physicians as well as the excessive costs involved with developing its infrastructure. Worth noting is that ASIP Santé, the agency originally responsible for the DMP, was removed from overseeing this task, which was then transferred to CNAM, the national health insurance fund. CNAM successfully revived the project by filling the DMPs with billing data, thereby providing them with usable content.

Israel

Israel, which features four major HMOs, is among the global leaders in the use of digital health and data exchange. However, the reluctance of Israel's Ministry of Health to introduce regulation in a context where strong independent HMOs prevail has meant that the HMOs have neglected to engage in data exchange among themselves. Having since recognized the urgent need for such an exchange, the Ministry of Health is currently working with all HMOs on the relevant regulations.

Italy

Though digital health is actively addressed at the national level and many incentives have been created, the lack of legally binding measures means that Italy's regional governments are ultimately responsible for implementation. The use of subsidies without further cooperation have not yielded the development of concrete solutions in the country. However, some of the country's progressive regions such as Lombardy already have a number of digital health applications in place and are international frontrunners in this area.

Canada

Canada's strong federalist system is relevant insofar that Canada Health Infoway manages subsidies as a strategic investor and disburses these funds exclusively in the form of project subsidies to individual provinces (CAD 1.3 billion, to date). Every three to four years and in consultation with national actors, Infoway sets a specific funding priority or strategic direction within which projects can receive support. This results in a coherent investment plan that allows the regions to maintain their rights of self-determination. National procurement rules and standards promote uniform industrial approaches. The system's cost-benefit evaluation is well-founded and thus a global leader in proving the benefits of EHR systems.

NHS England

The national top-down approach failed because the NHS tried to create a common architecture with all solutions for all NHS trusts, which simply could not be implemented in this form. Currently, NHS Digital provides a portfolio of solutions to the trusts which then decide which solutions they wish to offer. This approach has resulted in strong regional disparities in the availability of solutions.

Netherlands

Citing data protection concerns, the senate rejected, in 2011, a law on a state-organized exchange of health information. Since then, the existing infrastructure has been operated by private providers from self-governing organizations who exchange data on a decentralized basis exclusively within a regional framework, and it is regulated by the Association for Healthcare Communication (VZVZ), an umbrella organization for service providers in the Dutch health system. At the same time, there are parallel structures in place. The regional exchange of health information takes place beyond the existing infrastructure through other private providers. Generally speaking, the Netherlands features a pluralism of systems in which more than a million data transmissions take place each week.

Austria

The product of a lengthy planning process, ELGA should be viewed as a comprehensive architecture that is being implemented in a series of successive steps and according to specific modules or functions. Worth noting is the fact that individual elements of the healthcare system (e.g., hospitals, doctors, etc.) are connected to the system incrementally rather than simultaneously in order to minimize implementation problems and to quickly contain any such problems that do arise.

Poland

Poland's National Health Fund has yet to recognize digital health and in particular telemedicine as billable services. As a result, there are only limited offerings for these kinds of systems. In addition, hospitals in Poland do not have the financing needed to develop the required IT systems.

Portugal

The strong political will demonstrated by Portugal's Health Ministry is believed to be a key driver behind the extensive digital health landscape present in the country. The Health Ministry's Digital Health Agency (SPMS), under the direction of Henrique Martins – who also represents eHealth for the ministry, stands out for the fact that its projects are successfully implemented at both the national and EU levels. Another highlight is the development of the RCU2, a clinical patient record, which provides a clear summary of data collected for a patient that is readily available in emergencies.

Sweden

Sjunet is a secure broadband network for medical facilities exclusively that runs parallel to the normal internet. It is used to transmit ePrescriptions and other patient data in the form of a patient summary. Regions and districts play an active role in the discussion regarding digital health.

Switzerland

Because of the large number of veto actors in the country, the electronic patient dossier (EPD) will be introduced on a modular basis and will not be mandatory for outpatient physicians. Successful EPD projectathons are held annually to test various IT systems from private providers in order to ensure their compatibility with eHealth Suisse requirements.

Spain

The national government has reached a consensus with the regions to introduce a patient summary that can be exchanged nationwide. The political determination exercised by the current minister of health proved decisive for this breakthrough at the national level. Regional administrations, however, are continuing with the regional EHR system. Within the context of exercising their regional competencies, some regions in Spain have become international pioneers in the digitalization of healthcare systems (e. g., Andalusia), while others have performed significantly worse.

Strategies and institutions – a comparison

Digital health strategies: 13 of the 17 countries reviewed have a dedicated digital health strategy for the entire country. In Israel, the Ministry of Health has only recently intervened in the digitalization landscape of the country's four HMOs. Beforehand, each HMO had pursued their own digital health strategy independently. Italy pursues an overarching broad framework plan that is followed by the regions and defines specific goals and strategies. The same is true for Canada. Lacking a comparable strategy, the Netherlands features several independent strategies that are focused on digital health and which together form an overarching framework. Germany features an eHealth Act and various strategic documents that underscore the relevance of digital health for future healthcare. However, these developments form only a broad framework for digital health and in international comparison represent in no way a coherent and comprehensive strategy.

Digital health institutions: With the exception of Germany and Spain, each country reviewed (15) has a national agency or institution that has at minimum the authority to coordinate and supervise national or regional projects and developments. In some cases, competencies are distributed across several ministries. In seven of these 15 countries, these politically mandated institutions serve not only an advisory and coordinating function, but also issue binding regulations and standards and are therefore actively involved in the development process itself. In Germany, gematik carries out these duties to a limited extent. Using its own specifications for standards and technical requirements, it certifies new products for the telematics infrastructure and authorizes them for operational use.

ePrescriptions: In ten of the countries reviewed, the electronic transfer of prescriptions is already established. In six of these countries, this takes place nationally and in four countries this is limited to regional level. In nine of these countries, ePrescriptions account for more than 80 percent of all prescriptions issued.

EHRs and patient summaries: Four of the 17 countries reviewed have a national EHR system in place with at least one care sector involved. Notably, with the exception of Estonia, no country features an operating national EHR system that reaches across all care sectors. Regional EHR systems have been developed in six other countries. Austria is unique insofar as only the inpatient care sector is connected to the country's equivalent to an electronic health record, the ELGA. No cross-sectoral system has been introduced to date in Austria. In Sweden and Spain, patient summaries can be exchanged between regions throughout the country while in Belgium and NHS England, patient summaries are used only to exchange patient data across sectors.

Finally, table 48 summarizes the comparison of strategies, institutions and key components of focus in digitalization.

TABLE 48: **Overview of national strategies and digital health institutions:**

	Present nationally	Present regionally
Digital health strategy	**13 countries** (Australia, Belgium, Germany, Denmark, Estonia, England, Austria, Spain, France, Poland, Portugal, Sweden, Switzerland)	**4 countries** (Israel, Italy, Canada, Netherlands)
Digital health institution	**15 countries** (Australia, Belgium, Denmark, Estonia, England, France, Israel, Italy, Canada, Netherlands, Austria, Poland, Portugal, Sweden, Switzerland)	
ePrescription	**6 countries** (Australia, Belgium, Denmark, Estonia, Portugal, Sweden)	**4 countries** (England, Israel, Italy, Spain)
EHR and patient summary	**4 countries** (Australia, Denmark, Estonia, Portugal)	**9 countries** (Belgium, Estonia, England, Israel, Italy, Canada, Netherlands, Austria, Sweden)

Source: Bertelsmann Stiftung

7.2 Lessons learned and impact chains yielded by the five in-depth country analyses

In Part II of the report, an impact model was applied to define criteria of success in determining digitalization takeup. These success criteria were then applied in the in-depth qualitative analyses of digital health in five countries: Switzerland, the Netherlands, Denmark, Israel and France. The following features the experiences documented in each country and their impact chains with regard to specific criteria. The first block comprises political and social factors and the role of the healthcare system; the second block addresses the subject of digital health governance, which entails the entirety of structures and processes involved in the implementation of digital health, including strategies, laws, technical approaches, political leadership and the institutional anchoring of digital health.

7.2.1 Politics, society and the healthcare system

Switzerland

Switzerland features a strongly federalist political in which power is distributed across three levels of political administration. The high degree of self-government and separate jurisdictions of the multiple actors involved make political cooperation difficult, particularly with regard to the healthcare system. The Swiss propensity to hold referendums also represents a danger in that these votes are a source of potential vetoes. At the same time, however, Switzerland boasts a historical tradition of consensus-based policymaking in which the needs of individual interest groups are taken into account in order to achieve common goals. For example, the consensus reached with regard to the introduction of Switzerland’s electronic patient dossier (EPD) stipulated that the dossier would come into effect initially without the participation of outpatient physicians, as they had threatened to launch a referendum during the legislative process. At the same time, data protection plays a special role in Switzerland, as the rules regarding the introduction of the EPD explicitly prevent access to the data on the part of insurers. Widespread public concern that data could be used for financial gain accounts for this restriction. It nevertheless should be noted that many Swiss residents already participate in the telemedicine care contracts offered by their health insurance fund as a means of reducing their health insurance premium.

Netherlands

In principle, the Dutch political system – in particular its centralism – plays neither a positive nor a negative role in the digitalization of the country’s healthcare system. Here, too, the more challenging factors are self-government and the relatively large number of actors, which restrict the Ministry of Health’s scope of action. Data protection also plays an especially important role in the Netherlands, but it does so in a manner that is perhaps contrary to expectations. Thanks to an opt-out model, more than 80 percent of households in the Netherlands were already connected to the national electronic health record (EHR) by the time of the vote on the EPD law. Any concerns expressed subsequently with regard to data protection do not reflect the position of the population; instead, they are the result of a years-long dispute in the senate. The “damage” caused by the failed vote is manifested not only in the changes that have become necessary to the digital infrastructure, but also much more in the fact that hardly any physicians or patients are using the existing digital offerings, because they are poorly informed or not informed at all about the opportunities they provide. The Dutch therefore decided to prioritize app-based patient access to digital services and to couple this with a broad state-financed informational campaign.

Denmark

Although Denmark's political system is centrally organized, the country's regions and municipalities play an important role in healthcare provision. Broader decisions regarding the healthcare system are made by the central government, whereas decisions regarding administrative and specific organizational details take place at the regional and municipal levels. Regional administrative entities do not act as obstacles, however; instead, the implementation of digital measures was left up to the regions under the supervision of the national agency known as MedCom. Positive impact factors in Denmark include liberal attitudes with regard to modernization and technology, cultural, political and economic equality, dialogue, pragmatism, the willingness to compromise as well as a high level of trust in the state and overall system. At the same time, it is also true that Denmark as a whole is a highly digitalized country and the Danish population's knowledge of and willingness to engage with digital products is particularly high.

Israel

In terms of political structure, Israel has a centralized state with local administrative bodies, although this structure plays a mostly tangential role in terms of healthcare digitalization. The role played by the Ministry of Health, on the other hand, is highly significant. A functioning system emerged based on the fact that the various organizations operated by healthcare providers and insurers, HMOs and the Ministry of Health also have a clear and established division of roles. In principle, HMOs function independently and compete with one another, which means that it is left up to them to decide how to administer the guidelines. At the same time, it has proven advantageous that most healthcare professionals are SHI-authorized physicians employed by the HMOs and that the HMOs are responsible for guaranteeing the efficacy and satisfaction of physicians and patients alike. Israel's historically established culture and clear distribution of political roles brings with it a high degree of willingness to compromise and solve problems, which many stakeholders see as being beneficial. In addition to that, the low number of HMOs is advantageous for the digitalization process, seeing as only a few parallel systems need to be coordinated.

France

In France, the central government also plays a very strong role in the digitalization process of the healthcare system. Among the characteristics that are emblematic for France are the weak position of interest groups and the lack of consensus with regard to the form of government, including deep political conflicts between left and right. This has an impact on digitalization in the sense that many decisions are made at the central level and are delegated down. Still, France has repeatedly been faced with the problem of unsuccessful centrally launched political and administrative enforcement mechanisms, most notably because innovative services are not able to integrate into the everyday lives of end users. In addition, frequent changes in governments and impulses originating at the top of the system have a negative impact on the continuity of long-term developments and goals.

7.2.2 Digital health governance and technical approaches

Switzerland

Switzerland's relatively weak performance on the Digital Health Index can be traced back to the actual state of implementation and the nationwide exchange of data in mid-2018. Still, the outlook for Switzerland is better than for other countries, because the adoption of the EPD law shows that they are actively working on implementing the electronic patient dossier by 2019. In spite of the complicated constellation of actors mentioned above and the high level of federalism, there is now broad agreement on which steps should be taken next.

It must be noted, however, that the origin of the progress underway in Switzerland lies in project-oriented work being done in the regions and at university hospitals as well as in private sector IT endeavors. In terms of official policymaking, the approach primarily involves "allowing things to develop by themselves," especially due to the government's own lack of technical competency. Given this lack – and also at the instigation of industry – the eHealth Suisse was founded as a central coordinating point. Expanding the scope of the work done by eHealth Suisse to include digitalization strategies is especially valuable in this case, as they represent jointly defined targets and frameworks. The involvement of the IT industry meant that detailed certification standards were already contained in the EPD law's implementation guidelines and that these were subject to testing by means of regular EPD "projectathons."

Instead of pushing a large-scale national concept, Swiss cantons were given a free hand, which has ultimately benefited the decentralization of data and thus also data security. At the same time, however, it proved difficult to involve all stakeholders in equal measure, which led to a situation in which the physicians' association rejected the proposal for a mandatory, cross-sector EPD. Today, policymakers are counting on pressure from consumers (patients) to get physicians to become involved in the EPD. A key factor in the efforts made in the past several years are the eHealth strategies 1.0 and 2.0, in particular, as well as their relatively creative implementation in the form of the EPD law; indeed, without objectives and a certain level of pressure, the only solutions possible would have been industry-related or canton-proprietary solutions with no nationwide interoperability planning.

Netherlands

The Netherlands serves as both a positive and a negative example of governance. On the one hand, a national infrastructure for the application of an EHR was initiated under the auspices of the government by means of the National IT Institute for Healthcare (NICTIZ) and enjoyed a highly advanced level of usage in part thanks to its opt-out provisions. On the other hand, the law that was designed to place all previous efforts into unified legal framework was rejected by the senate due to concerns over data protection.

This setback immobilized digitalization efforts in the Netherlands for several years and rendered further government-driven initiatives unthinkable. However, thanks to politically topical issues, such as big data and health analytics, political leaders have now once again taken up the issue of digital health and thus also EHRs. As a result of the efforts of leading politicians driving forward the digital health agenda, the Netherlands' health IT industry blossomed. A new health information council has been created to act as the coordinating body between the Ministry of Health and the most important actors in an effort to improve the rather low-level cooperation among stakeholders. The voluntary nature of the council and its members' mutual desire for progress has now led to binding resolutions in individual cases.

And yet, seeing as things have nevertheless more or less come to a standstill, calls on the government to formulate clear goals and regulations are growing. While the Netherlands has legal regulations stipulating that healthcare professionals must create digital clinical records, patients must still explicitly agree to data exchange (opt-in). However, opt-ins remain infrequent due to a lack of information on the side of both patients and healthcare professionals.

Denmark

The healthcare system in Denmark provides healthcare on a regional level, and this applies to digital development, as well. Here, too, digital health initiatives and individual EHRs got their start in local initiatives, whereby some projects went on to grow nationwide. The MedCom agency is the result of a European project. The large number of small applications that emerged caused the state to act as a regulatory authority. In spite of – or perhaps precisely because of – the regional nature of the systems, no national EHR has been introduced to this day. Instead, they have agreed to have one system per region.

Further reasons for Denmark's good showing on the Digital Health Index can be found in the country's existing conditions, such as the national NemID signature (a Danish log-in and authentication service for public digital services), its highly digitalized administration and numerous digitalization strategies. Here, too, the various actors see strategies as visions and recommendations for action. The implementation of digital health takes place initially without restrictions, albeit within a set framework. One special feature of the Danish approach is the involvement of end users – including physicians and patients – in the development of the EHR as well as other digital health applications and the digitalization of specific treatments.

Israel

Without any active involvement on the part of the Ministry of Health in the day-to-day operations of the HMOs, these bodies are free to determine how they will implement digital health within regulative frameworks. The Ministry of Health implements the solutions that have been developed and hands these over to the HMOs. It also develops and operates the infrastructure used by the HMOs. What this means for digital health is that the HMOs were able to initially develop a number of approaches independently. These developments, however, always automatically impact the entire country, because there is no regionalization of the operators. The HMOs built up digital health in Israel independently and based on their own self-interests without any direct guidelines from the state; indeed, as independent organizations, they manage healthcare services themselves and thus also the level to which they adopt digitalization. The ministry has only been actively involved in healthcare for roughly 10 years now; it has been supporting the digitalization of the healthcare system for roughly five years. In the form of the Digital Health Plan, a political framework was created in which free, technical competition was made possible. The HMOs entered into cooperative projects with the IT industry early on; today, the state-run Digital Health Plan represents the third actor in the ensemble, where it plays first and foremost a controlling and regulating role. Thus all relevant actors are involved in the planning and implementation of digital health.

One of Israel's forthcoming significant challenges will be to establish interoperability between the data networks of each individual HMO. This will require regulatory intervention on the part of the Ministry of Health.

France

In France, one can speak of a "top-down process" in which the central government introduces and regulates innovations and new features "from above." The DMP *(Dossier Medical Partagé)* was introduced as a pilot project as early as 2004 and put into nationwide operation in 2011. It was subsequently "forgotten" all the more quickly after that, seeing as it attracted very few active users. One of the reasons for this was its lack of user-friendliness. After a years-long phase in which the project was put on hold at great financial cost, the project was taken up once again, redesigned and subjected to a new pilot phase.

In the case of France, it is very noticeable that the introduction of state-run projects tends to swing back and forth between progress and stagnation. While a national strategy for the introduction of EHRs and ePrescriptions indeed exists, there is often a lack of political support for it. Here, in particular, the centralized nature of the political system has a negative impact, especially because progress depends entirely on each respective government. As a result of the marked differences between liberal and conservative parties, it can sometimes happen that existing projects introduced by the previous government are simply not continued by the successors.

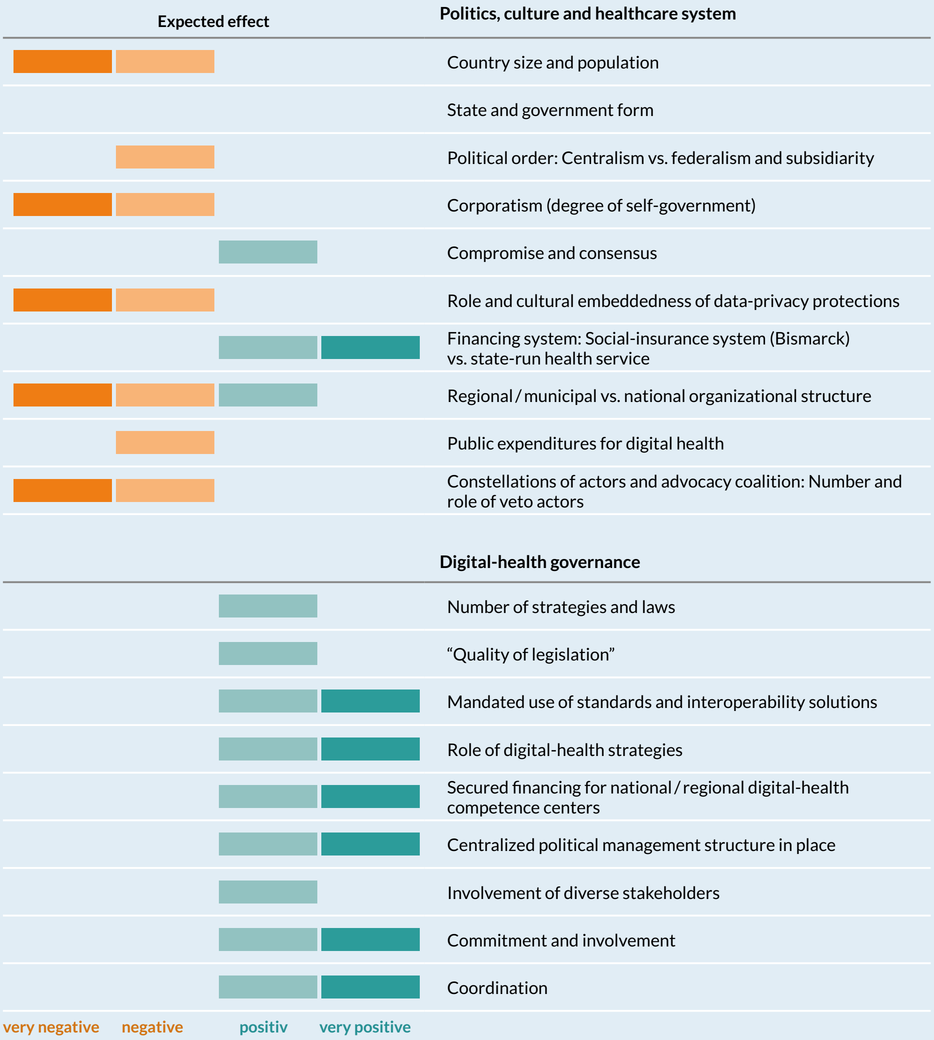
The change from the eHealth agency ASIP to the national health insurance CNAM as the responsible body led to the relaunch of the DMP and a subsequent increase in its user numbers; indeed, the CNAM has local administrative structures with closer contact to local providers and, as a national health insurance fund, is also permitted to transfer – to a certain extent, automatically – existing databases to the EHR. At the same time, however, the report nevertheless showed that end users were still not adequately involved in the development of the service. On the one hand, the regions were supposed to pilot the projects; on the other hand, the conditions necessary to do so do not exist in all regions, which leads to enormous variances in planning and implementation.

7.2.3 Anticipated and observed effects of influencing variables

At the beginning of Part II of the report, statements were made about the anticipated effects of various influencing variables on the state of digitalization in the five countries surveyed. Figure 62 contains a graphical representation of these expected effects, while the second figure reflects the actual observed effects using available empirical data from the countries surveyed. The colors depict the negative effects in red and the positive in green, while the length of the bars illustrates the respective force of the effect.

The following is an evaluation of the examination of individual influencing variables. The evaluation is based on the observations made in the five countries surveyed. It shows first that the variables from the first block, namely "Politics, society and healthcare system," have a smaller positive impact on digitalization than variables from the second block, namely "Digital health governance."

FIGURE 62: **Anticipated and observed effects of influencing variables on the state of digitalization**



Source: Bertelsmann Stiftung

1. Politics, society and healthcare system

Country and population size: Particularly noticeable is that only a small negative effect has been observed in the realm of "Country and population size." It is possible for countries with a relatively large population and country sizes, such as Canada (2nd place on the DHI), to be ranked above countries with small population and country sizes. Among the countries surveyed, France counts as a country with major problems. Other countries, such as Switzerland, struggle with complicated political constellations despite their small size.

Form of state and government: Much like size and population density, a country's state and government system is also not a determining factor. In other words, according to the available, data the state of digitalization in a country is not dependent on a state's legally mandated form.

Political order: Centralism vs. federalism and subsidiarity: Another striking feature within the first block is the fact that federal states and those with regionally organized healthcare systems enjoy an advantage over national systems. This illustrates a "scaling-up effect" whereby projects that are already successful at the local and regional level are applied at the national level.

Corporatism (degree of self-government): The higher the degree of self-government in each of the countries surveyed, the worse they scored in terms of the state of digitalization. However, the figure was much lower than expected; this is no doubt due to the small number of countries with a high degree of self-government, thus making a comparison difficult.

Compromise and consensus: An especially positive factor for the state of digitalization is the willingness to engage in compromise and policies of consensus. In countries with high scores in these categories, it was shown that advances in digitalization were more easily achieved with the help of a corresponding attitude. Conversely, the unwillingness to compromise and a lack of consensus were seen to have a particularly negative impact on the state of digitalization.

Role and cultural embeddedness of data-privacy protections: As expected, culturally entrenched concerns with regard to data privacy lead to a less developed state of digitalization than in countries with liberal attitudes toward the subject. However, the impact was lower than expected.

Financing system: Social-insurance system (Bismarck) vs. state-run health service (Beveridge) vs. hybrid systems: Among the different healthcare financing systems, countries with state-run healthcare services have an advantage over those with social security systems. One reason for this could be the easier controllability of the actors within the system.

Regional / municipal vs. national organizational structure: In contrast to the expectation that regionally organized healthcare systems are a hindrance to digitalization, this category makes it clear that the exact opposite is true. Despite the small sample group, countries with a regionally organized healthcare system displayed a noticeably higher state of digitalization than those that were centrally organized. This, too, is most likely attributable to a greater focus on tangible application.

Public expenditures for digital health: When it comes to public spending on digital health, increased spending is not necessarily associated with a higher state of digitalization. Even with relatively little expenditure, as is the case in Israel, it is possible to design and manage digital healthcare in an expedient manner. In contrast, in France, large amounts of money were spent with only relative success.

Constellations of actors and advocacy coalitions: Number and role of veto actors: The factor with the greatest negative influence on digitalization seems to be the number of veto actors and the role they play. While compromise and consensus are beneficial, coalitions of veto actors are capable of causing many projects to fail. In this realm, it becomes clear that cooperation among different stakeholders is essential. As a general rule, the greater the number of conflicting interests, the more difficult it is to adapt and make tangible progress.

2. Digital health governance

Number of strategies and laws: The expectation that an increasing number of digital health strategies and laws improves the state of digitalization was confirmed in principle; however, the magnitude of the effect was shown to be minimal. In other words, the quantity of strategies and laws was shown to be irrelevant.

"Quality of legislation": In this realm it was shown that well-designed and especially straightforward digitalization laws – or additions to existing laws – have a positive effect on the state of digitalization. It is important to note here that excessive legal regulations were actually seen to be disadvantageous.

Mandatory application of standards and interoperability solutions: As expected, it was observed that the mandatory application of standards and interoperability solutions has a tremendously positive impact on the state of digitalization.

Role of eHealth strategies: The role of eHealth strategies should not be underestimated. Although the observations show a positive impact on digitalization, it is nevertheless not as strong as expected. This might be due to the fact that countries such as Israel, France and the Netherlands have few or no specific strategies to show for themselves. In general, it was shown that countries with good, target-oriented strategies saw an extremely positive influence on digitalization.

Secured financing of national / regional centers of digital health expertise: The setting-up and financing of national / regional centers of digital health expertise was seen to have a very positive effect on the digitalization of the healthcare system. As a rule, these centers were also associated with efforts to generate and set standards and interoperability (see above).

Installation of central political management: As expected, political committees and other institutions set up to steer and manage digitalization efforts have a positive impact; the extent of the impact is not as strong as expected, but a clear effect was able to be identified.

Involving various different stakeholders: As expected, it is important to involve the full range of stakeholders in order to achieve an improved state of digitalization. The timely involvement of all actors increases the likelihood of joint solutions and essential compromises (see above).

Commitment and involvement: Contrary to expectations, it was shown that active and involved political leadership contributes only slightly to improved digitalization. However, the actual results are dependent on each respective country. In Israel and Denmark, there was no reason for politicians to get actively involved in the past, seeing as the issue of digital health was handled by other actors. In the Netherlands, efforts made by the political leadership revived the issue, which is why these efforts can be seen as being groundbreaking for new progress.

Coordination: Also contrary to expectations, it was shown that the variable of proactive political measures (coordination), while indeed showing a demonstrable positive impact, was far from the level expected. One reason for this might be the small scope of countries surveyed. It might also point to the fact that too much political influence does not have as positive an effect as expected.

7.3 Impacts and success criteria

7.3.1 Conclusions derived from the benchmarking report

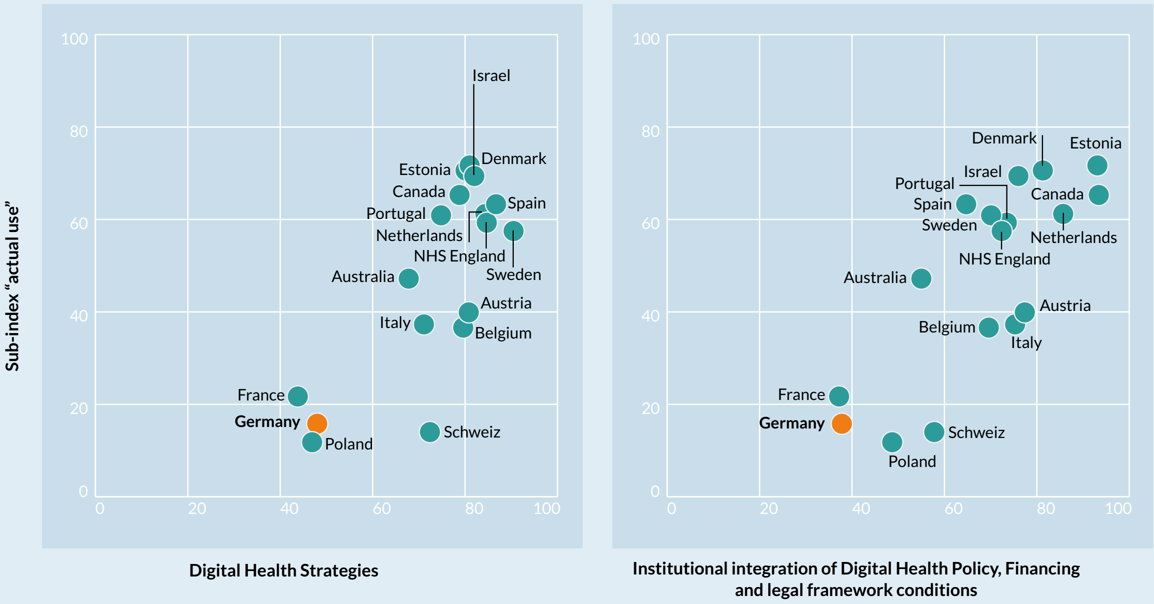
Using the summaries of the country surveys in the general report and drawing on the experiences and impact chains contained in the in-depth country analyses, it is possible to draw conclusions with regard to overall impacts and criteria for success. These include the influence of digital health strategies and the institutional anchoring of digital health in the form of laws, institutions and financing.

Digital health strategy

The role played by digital health strategies can be derived from the data contained in the transnational benchmarking part of the report and also from the more in-depth country comparisons. This data shows that most countries have a digital health strategy. The findings show positive correlations between the existence of digital health strategies and actual use of data, as seen in figure 63. Actual use of data in Switzerland is rather low, which is due to the relatively recent implementation of the EPD law; at the same time, however, the eHealth Strategy 1.0 and 2.0 contributed to the EPD law, thus fostering the process in a sustainable way.

In the Netherlands, a number of documents on the subject of digital health have been written up, but the country still has few explicit strategies for creating and applying a national EHR. In this case, it became clear during the on-site analysis phase that dedicated visions and framework conditions from digital health strategies are expected. All in all, it was shown quite clearly that the existence of a generally accepted and well-formulated digital

FIGURE 63: **Comparison of the indicator "digital health strategies" and the indicator "institutional anchoring" with the sub-index of actual use of data**



Source: Bertelsmann Stiftung

health strategy – one that is more than just a law – has a positive influence on digitalization.

Institutional anchoring

It is also possible to draw conclusions from the data with regard to the importance of the totality of structures and processes in place for the implementation of digital health. Figure 63 confirms that factors such as financing, legal framework conditions and institutional anchoring generally correlate positively with the actual use of data. Seeing as no distinction is made here between individual indicators, it is, in turn, interesting to look at the more in-depth country analyses. Using the examples of France and Germany, it becomes clear that large amounts of financing alone do not automatically lead to a high level of data use. Institutional anchoring via separate digital health authorities, such as in Denmark or the Netherlands, also does not alone explain the high level of data use.

Here, too, it is illuminating to look at the example of France, where a national agency for digital health exists, but where small user numbers in the specific example of the DMP reflect a low level of success. It becomes clear that a specific set of factors exist in most of the successful countries; as mentioned above, these factors include financing, legal framework conditions and institutional anchoring. The last factor must be seen as being especially important: It is key that institutional actors are given a corresponding power of enforcement and always seek to cooperate with end users with regard to any applications they want to introduce. They can thus participate in a form of co-design with patients and physicians.

7.3.2 Generalizable patterns for successful digitalization

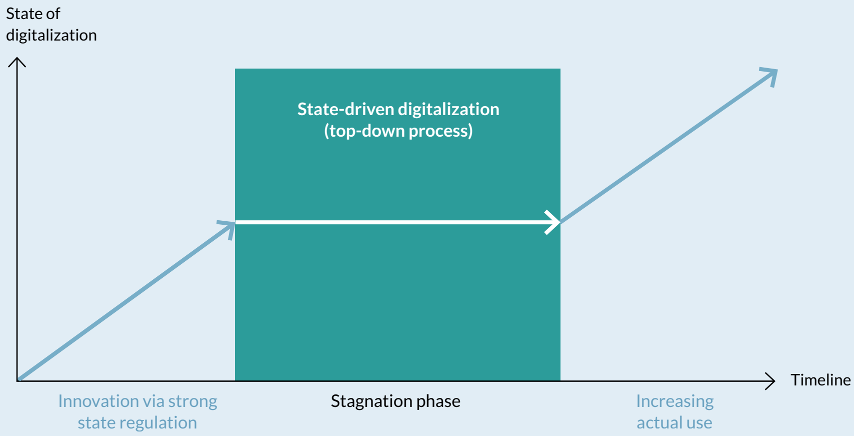
Although not all criteria for success can be applied to all countries, and although each country has its own political, social and systemic preconditions and differing healthcare systems, actors and legal situations, it is nevertheless possible to derive generalized patterns and principles from the experiences and findings in the countries surveyed.

Interplay of legal-regulatory frameworks and digitalization success

As already shown, a country’s legal-regulatory framework plays a prominent role in digitalization. Certain conclusions can be drawn from the experiences contained in the report, and can be summarized in the following two prototypical development paths:

1. The first digitalization process assumes a strong state-run and centrally driven approach to digitalization (examples of this being England, Australia and France, in particular). This means that binding framework conditions are created by the government or another responsible state authority, which also stipulates the use of specific standards or systems. All developments in the realm of digital health are then obliged to follow these stipulations.
2. The second process of digitalization that emerges here is driven primarily by non-state actors; in this case, the greatest portion of work is undertaken by the IT industry, local or regional providers and other private stakeholders. As a result, this initially creates a highly fragmented digital health landscape.

FIGURE 64: **Digitalization development driven by high levels of policy activity and state guidance**



Source: Bertelsmann Stiftung

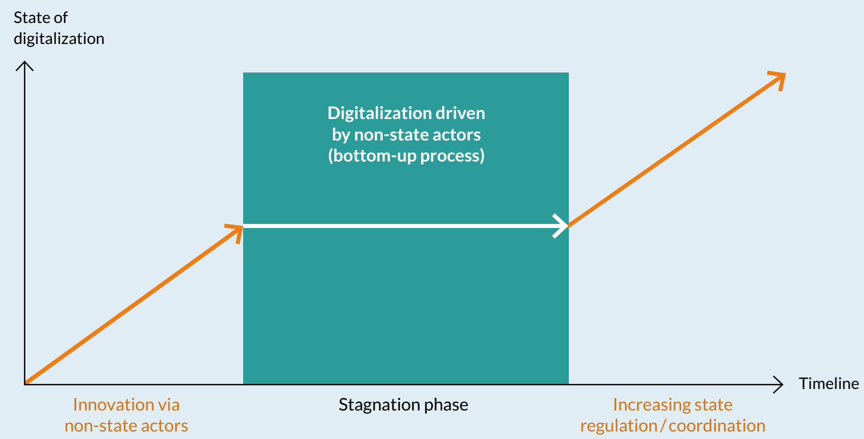
High-level state regulation

When the process of digitalizing the healthcare system originates from state institutions (e.g., ministries of health, national health authorities, etc.), it begins by creating framework conditions and developing standards. These are then implemented (in part) technically, depending on the means and motivation of the actors involved as well as on the number and range of stakeholders. Oftentimes an infrastructure comes into existence which, however, is not used since users (physicians, laboratories, health insurers, hospitals, patients, etc.) are either critical of the changes and do not recognize the associated advantages of the applications or because these applications are not (fully) implemented in the spirit of and to the benefit of all actors.

There could be many reasons for this: lack of training, lack of change management, a premature launch of systems, unresolved user issues or the failure to involve all actors in a timely manner. Attempts are often made to overcome these barriers via "mock-ups" or various incentives (often financial ones). This process is characterized by the fact that a wide range of application areas are integrated simultaneously in a complex model at an early stage (examples include France, England, Australia and, to a certain extent, Germany).

In order to break out of the stagnation phase, it is necessary to place a certain degree of restraint on central or state governance and influence. As a rule, the framework conditions already in place function as inhibitors to innovation. Regional healthcare systems, in particular, as well as those with many strong actors and a high level of self-government, suffer from overregulation or improper regulation. In this case, it often proves useful to trim down the large overall (national) structure, to give actors more freedom to act and to focus efforts on linking the systems that subsequently develop.

FIGURE 65: **Development of digitalization by non-government actors**



Source: Bertelsmann Stiftung

Distinctly non-government coordination

The second prototypical path, illustrated in figure 65, represents a process of digitalization that is driven forward by non-government forces. In this case, one or many of the actors involved in the non-government health sector (physicians, laboratories, health insurers, hospitals, but also self-governed regions or the IT industry) develop digital solutions designed to address concrete needs that are applicable in a very limited (regional or provider-specific) framework. Depending on the number of individual providers and potential collaborations, it is possible for several parallel standards / solutions to develop at the same time. Examples of this can be found in Denmark and Israel. After this, however, the digitalization process stalls (stagnation phase), seeing as the isolated solutions are often incompatible with each other and no national solution is found. Problems usually have to do with interfaces, standards and interoperability.

At this moment in this scenario, many stakeholders begin to call for regulatory intervention. In Denmark, the regions approached the national institutions, and in Israel, HMOs asked the national Ministry of Health for coordinating support – not the other way around. The establishment of coordinating organs and a well-formulated digital health strategy can already serve a regulatory function and help to set up framework conditions and define goals. Binding specifications can be also instituted on the basis of existing solutions in order to bring these solutions closer to one another. Only this increase in regulation will serve to relaunch the digitalization process.

Summary

In both scenarios, advancement in the state of digitalization takes a similar path, with reasons for this varying according to each scenario. The state must undertake either a process of regulation or deregulation. In turn, innovation processes undertaken by non-government actors are sometimes necessary and sometimes a hindrance. At a certain point in time, the other party must become active for the process to be continued in a meaningful way. Consequently, both tendencies must be involved to ensure the successful digitalization of a healthcare system.

Overall, the data showed that local, so-called “bottom-up” solutions – what one might call IT-driven “grassroots” movements – as well as regional projects and user-based, small-scale solutions are often successful, however only up to a certain point. From this point on, government regulation becomes necessary, however only in a guiding, management capacity, rather than in a determining one. In particular, the involvement of stakeholders is absolutely necessary at this point, ideally even in closely coordinated and manageable committees. The most important element here is that co-design – that is, the needs and perspectives of end users – is involved in the process of innovation.

The reviews of each country featured in this report show that that instead of targeting a complete system or comprehensive architecture, fostering innovations incrementally by module and in terms of needs and usage, while using open data models and interfaces, is preferable. According to the observations made in the report, it is precisely the needs-based applications that arise out of necessity that lead to the greatest advances in the digitalization of a healthcare system. However, the challenge in the long run is effective communication between different systems. In order to ensure this communication, timely regulatory intervention and a coherent vision / strategy for further action is necessary.

Lessons learned

Successful implementation of a comprehensive modular architecture

The introduction of a centrally designed overall architecture can work, in principle, when it is implemented in a modular fashion. Positive examples of this are found in Austria and Switzerland. Much like in Australia and England’s NHS, these two countries see detailed planning in various committees and councils with regard to which exchange standards and terminologies the individual modules and / or uses (eMedication, eDischarge or eReferral) of the subsequent architecture should be based. Once established, technical implementation is carried out in regional pilot schemes in the federal states and / or cantons. Initially on a trial basis, a single care sector is also connected to this module. In this phase, technical and planning-related deficiencies can still be remedied and adapted relatively easily. However, in addition to the long planning phase, such modular implementation can take up to ten years. The advantage: in retrospect, the tendency is that less money is spent on fixing mistakes in advance that otherwise would quickly cost up to hundreds of millions of euros at a later date. A similar procedure was used in Portugal to introduce the individual modules involved in the PDS health information platform.

Regional healthcare system and national exchange via patient summaries

In spite of the hurdles associated with decentralization, countries with regionally organized healthcare systems – and thus diverging levels of regional digitalization and differing EHRs – are also able to exchange patient data at a national level. This often takes place via a patient summary system. In these countries, both federalism and the clear benefit of providing important patient data at the national level are taken into account. Allergy and medication data as well as information on operations and vaccinations is made available to physicians in the form of master data records or patient summaries; these can be used for making important decisions in emergencies (e. g., the choice of antibiotics and pain relievers in relation to allergies or resistances, regardless of the patient’s location. (Belgium, NHS England, Portugal, Sweden, Spain)

Coordinating digital health authorities and the willingness to cooperate

Especially in federal systems, establishing and endowing a digital health institution with decision-making authority and coordinating power is crucial to the success of digitalization. It is essential that cooperation exist among the different actors in the healthcare system, which usually includes health insurers, providers and the IT industry; this cooperation makes it possible to offer coherent national and regional solutions. Work on the individual details must also be planned and managed over the long term in order to be able to address certain issues, especially those that arise beyond the technical development of standards (e.g., Who is permitted to access which data in what manner, when and how? How is this access supervised? etc.).

Yet another one of the factors essential to the success of new digital solutions is acceptance on the part of those individuals who actually make use of the solutions. For example, in countries such as Switzerland, the physicians' association resisted the introduction of the EPD; this led to a situation in which outpatient physicians were initially not obliged to use the EPD but were included on a voluntary basis instead. Other providers are required to introduce the EPD. In the Netherlands, there were objections to the introduction of an EHR, and physicians in Denmark also lodged complaints. However, especially in Denmark, patients and physicians were actively involved in the development, so that overall resistance is low.

It was observed on several occasions that penalties for failing to meet deadlines were established in law as part of the introduction of certain digital applications. It was shown, however, that to date no penalties were actually imposed in any of the countries surveyed, seeing as political pressure and other factors on the part of providers were too great. In the Netherlands, but also in Spain, Denmark and Israel, various actors are working together in spite of their different and oftentimes conflicting interests and are making a joint effort to drive digital health forward constructively and efficiently. The willingness to cooperate and compromise was emphasized on many occasions during the interviews for this report (in particular in Switzerland, Netherlands and Denmark). In Germany today, we observe the opposite; in direct international comparison, it appears that the willingness to cooperate is not very pronounced, in particular between the actors of self-government. With regard to central issues, it often takes a long time to reach agreements; in other words, a joint target and common vision is missing. Openness in communication with all stakeholders also plays an important role here.

The establishment of a digital health institution in the form of an authoritative body was carried out in most of the countries surveyed, either as a body affiliated with a national ministry or as a non-profit state-sponsored organization. However, with regard to standardization and the design of digital solutions, the only countries that were especially successful were those that had defined standards and profiles in cooperation with healthcare provider associations and self-governing actors, as well as with federal actors and industry (Canada, Switzerland, Austria, Portugal), or where parallel infrastructures were set up to which providers were subsequently connected (Sweden, Estonia, Denmark). In other words, a binding legal character is not a mandatory criterion for success. In fact if all key actors participate in the process and are motivated, they will ultimately adhere to the related specifications.

Digital health strategy: signpost and motor for the healthcare sector

The role played by digital health strategies can be seen as a generally positive one. In those countries in which a digital strategy exists, it functions as a role model for the key stakeholders, and especially for those developers who do not design their new technologies haphazardly, but instead seek to bring their activities in line with national efforts. At first glance, many countries have produced strategies that appear to have little relevance in the everyday work of planning and implementing digital health-policy efforts; however, if one looks closer and from a long-term perspective, many observers would agree with the statement "people are drawn to a shared flame."[527] This is to say that all actors follow a common goal, sometimes in an unconscious and internalized manner. Also, discussions about the fundamentals were not seen as leading to any tangible exhaustion of stakeholders' resources and energy at the expense of actually expanding and fostering digital solutions.

The intensive involvement of patients and physicians' associations in the steering and development of such strategies is particularly essential to achieve the subsequent benefits of new technologies. Here, too, the involvement of end users plays an important role. In fact, is it the physicians who will ultimately be applying these digital health solutions and filling them with information; after that, the patients are the ones who are supposed to profit, for example, in the form of an independent data flow in such solutions (Denmark, Sweden, Belgium, Austria, Portugal, Estonia, Switzerland, Spain, Canada, Italy).

Potential barriers

In a manner similar to the development of criteria for success, it is also possible to determine common hurdles to digitalization.

The introduction of a centrally planned overall architecture bears risks

The idea of introducing an overall digital architecture planned years in advance and pre-defined in a top-down process almost completely failed and was associated with considerable financial expenditures, at least in the state healthcare systems in Australia and England. In this case, it was possible to discern particular problems with regard to the integration of the EHR systems and their exchange formats; the systems were subsequently able to be launched only with extensive financial outlays. The method of "imposing" a pre-planned overall system architecture to the entire healthcare system carries similar risks and has very little flexibility and adaptive capacity. Today, more than € 100 million in expenditures later, digital health in Australia exists only on paper; in fact, with the exception of ePrescriptions, hardly any relevant data is exchanged. In England's NHS, each trust functions as a local care provider unit and can make decisions in favor of individual digital solutions from a large portfolio that sets only a central framework. The dismantling of the central national success of an overall system architecture in the NHS goes so far that some trusts rely on open-source solutions such as OpenEHR in their approach to ePAs while others use the large and expensive solutions provided by well-known software producers.

527 Interview during on-site research trip, Denmark.

Lack of investment in infrastructure

Lack of investment in the expansion of broadband networks in Australia has led to telemedicine services generally only being offered in urban areas, where they are in less demand than in the outback, and where the large majority of potential beneficiaries of a telemedicine infrastructure actually live. For this reason, the degree of penetration is low and the benefits of such services are limited. Digital infrastructure and digital services can only be efficient if they are also accessible to all potential users. Capacities with regard to the rate of transmission and amount of data exchanged must also be taken into account. Furthermore, the type of financing of infrastructure expansion remains a decisive factor.

Opt-in can negatively impact the benefits of solutions

Designing digital health-solutions in the form of an opt-in system can lead to low use rates in some countries. In combination with communication and awareness campaigns, it is possible to raise awareness among the population and ultimately to increase the number of users for such things as EHR systems. A negative example can be found in the digital health landscape in the Netherlands. Since the switch to an opt-in model, the number of users is dwindling, a state of affairs that can be traced back to low-level knowledge on part of physicians and patients and a lack of awareness campaigns.

In response to low user numbers, Australia transformed its My Health Record into an opt-out system, wherein citizens now have to actively withhold their consent if they do not want a file to be created. It is expected that this will lead to an increase in the popularity and increase benefits of the EHR. In Europe, in light of the General Data Protection Regulation and remaining legal uncertainties, no conclusive recommendations can be made as to whether and to what extent an opt-out would be possible on the continent.

Nonexistent or insufficient digital health strategies and coordination

When a country lacks an overall national digital health strategy that has well-defined goals, approaches and visions and that provides guidance to actors in the healthcare system, this lack can contribute significantly to the emergence of a disorderly landscape comprised of local projects and individual actors who fill the strategy vacuum. In Israel, the Ministry of Health stayed out of healthcare until only recently, leaving all strategic developments up to the four HMOs. This led to each HMO developing their own digital health landscape, each of which is now among the most advanced in the world. However, with regard to the organization and development of data exchange between the HMOs and independent medical facilities, there existed no framework and no willingness on the part of the HMOs. In this case, the Ministry of Health was explicitly requested to step in and take over the necessary coordination.

Subsidies alone are not enough

Taken alone, the subsidies and stimulus financing assigned to digital health strategies and laws are sometimes not enough to drive forward the development and implementation of digital solutions. This was shown to be the case in Italy, where the regions were promised financial means at the national level if they started offering digital health applications. The current state of affairs shows, however, that not all regions are taking up the offer. On the one hand, this is due to regional political and economic-structural peculiarities; on the other, it is also the result of a lack of fixed timeframes and associated penalties that would make certain solutions compulsory. The success of this idea is reflected in the elimination of paper prescriptions throughout Italy; in this case, healthcare providers that did not introduce the ePrescription could be penalized. All of this was made possible only thanks to a consensus among different actors, with penalties used as political and economic levers.

7.4 Transfer analysis: Transferability to Germany

Conclusions and findings derived from the overall study as a whole, the findings should ideally be used to facilitate the transfer of promising ideas and strategies into Germany's healthcare system and political practice. The objective of the transfer analysis is to derive impetus and recommendations from the country comparisons regarding political processes that could transpose, initiate or accelerate the digitalization of the healthcare system and the necessary related measures.

7.4.1 Transfer of key success criteria: Is importing policies possible?

Conclusions from international comparative studies that offer recommendations essentially as direct policy-import strategies should be viewed critically. Nevertheless, from a scientific point of view – as well as from the political perspective – it must be acknowledged that *policy-learning* processes have always taken place internationally, even if mostly implicitly. In addition, most political actors, and certainly those within the EU, are familiar with the concept of international two-level games.[528] As a strategy, this translates into, "Politically, I must implement something domestically, because 'Brussels' demands it of me, and I have no choice." Moreover, genuine lessons have been learned in the context of large EU eHealth initiatives such as the epSOS project[529] *(Smart Open Services for European Patients).* In these international projects, national ministries have been able to see exactly how far their neighbors have advanced with regard to digitalization, while learning from their European allies' previous experiences. These insights have been introduced into domestic structures and political systems, producing changes based on, or at least inspired by, these lessons.

This report also had the goal of explicitly presenting *lessons learned* derived from the country comparisons, with the aim of accelerating the digitalization of the healthcare system from a national and political perspective. One aspect of this task is the identification and description of possible starting points for the acceleration of digitalization. Similarly, we seek to describe conditions for success that remain meaningful against the background of the German self-governance principle, while also being transferable in the broadest sense.

The intuitive assumption regarding Germany, that the country's complex and unique healthcare system does not allow for it to learn from other countries, culminates in the justified question of what, for example, Germany can learn from Estonia, a small post-socialist system with a state-run healthcare sector. The question can be answered from two perspectives.

528 Putnam, Robert (1988). "Diplomacy and Domestic Politics: The Logic of Two-Level Games". *International Organization.* 42: 427–460.

529 The EU-funded Smart Open Services for European Patients project (epSOS, 2008-2014) focused on creating cross-border access to patient summaries and ePrescriptions. epSOS was conceived as a pilot project that was carried out on a large scale with the initial participation of 12 EU member states, and later expanded to 25 participating countries.

1. First, the different countries examined and digital accomplishments described are to be seen as inspiration regarding what is generally possible with digital infrastructure and solutions. For example, we have described what is directly used by patients and physicians in the context of routine regional and national activities. The report has been able to trace both the breadth and depth associated with digitalization strategies, implementations and the actual use of data. Under this first perspective, the lessons derived serve primarily as general motivation and inspiration, and as the source of visions for the sustainable development of strategies. The effort to distill what is specifically transferable takes on a secondary role.
2. Taking on the second perspective, a transfer analysis for the German healthcare-policy context succeeds if the conditions for success within each specific healthcare system are consistently defined with reference to the German self-governance principle. These German system conditions were inherently taken into account in the report's design, both in the selection of benchmarking indicators and in the effects to be observed within the in-depth country analyses. Furthermore, we address the current situation in Germany below, using this information to place systematic German particularities into the context of this report's findings and the associated criteria for digitalization success. The final chapter of this report represents the conclusion of the transfer analysis examining transferability to Germany, taking the form of derived recommendations for German digital health policy.

7.4.2 Current state of digital health in Germany

The federal government's competence to issue framework legislation for the healthcare sector, combined with the principle of self-government, leads to a diversity of political activities and statements on the issue of digital health in Germany. Currently, there is no general strategy on the horizon, for instance that would integrate research issues and the use of mobile healthcare applications (mHealth) in a coherent manner. Overall, however, an increasing consciousness of the importance of an general strategy has been evident within the government and among self-governing entities, associations and political parties. We aim here to shine a critical light on the current approach, including the construct of gematik, the joint initiative of self-administration bodies of the German healthcare system, as the entity tasked with developing and operating the telematics infrastructure. Currently, gematik does not appear to be either legally or politically capable of coordinating and managing a national, centralized system with all relevant stakeholders.

While the last legislative period saw the passage of an eHealth Act, this only highlights the continued failure to roll out the use of electronic health cards on a nationwide basis. To encourage such use, the legislature combined financial incentives for the use of the telematics infrastructure (TI) with binding deadlines for the introduction of individual applications. Penalties for failing to meet these deadlines were also planned. However, a series of developments have led to a situation in which industry stakeholders have been unable to observe the provisions of this law, or in which regulatory adjustments have become necessary. Worth noting here have been the delays in the delivery of the new generation of TI connectors, the appearance of EHRs created by individual health-insurance companies, and the recurring discussions regarding the significance of mHealth and smartphone-based data access. The government parties included a de facto revision of the eHealth Act in the coalition agreement for the 19th legislative period.

The development of standalone insurance-provider solutions in particular, even if they are claimed to retain compatibility with the telematics infrastructure, has only served to amplify calls for a general strategy for Germany. At the beginning of 2018, the eight associations making up the commercial healthcare industry, including BIO Deutschland, Bitkom, the Bundesverband Gesundheits-IT, BVMed, SPECTARIS, VDGH, vfa and ZVEI, appealed for the development of a national mission statement, and the implementation of an eHealth strategy deriving from it.[530] The problems associated with the lack of a strategic framework have been pointed out in the past.[531]

The results of the benchmarking portion of the present study show Germany to be at 16th place in the country rankings. This position can be interpreted as the result of a policy that – in contrast to the success factors described above – has specified and tested a national telematics infrastructure using a top-down approach. After many years of technological progress that has taken place outside the telematics infrastructure, the necessity of making the self-governing actors themselves take responsibility for the success of individual applications has been recognized only belatedly.[532]

In Germany, discussions on the issue of digital health are taking place in many corners, against the background of a broad variety of vested interests and perspectives. New dimensions have been reached since the beginning of the independent development of EHR solutions operating parallel to the telematics infrastructure. As this report was being completed, for example, the National Association of Statutory Health Insurance Physicians was requesting that it be given responsibility for setting the standards for electronic health records.[533]

However, according to the state of affairs current at the time of writing, gematik, the organization responsible for the telematics infrastructure, was expected to set the standards necessary for an electronic health record system by the end of 2018. The current authentication procedures, using the two-key principle, were also to be revised by the end of that year. Some initial possible changes were contained in the ministerial draft bill of the Appointments Service and Care Act (TSVG), whereby patients would be allowed access to their EHR even when they are not in the presence of their doctor. In addition, this access would be possible using a smartphone. At the time of writing, it remained unclear how smartphone access would be regulated if the objectives and purpose of the specific use of data still remained to be fine-tuned.

However, there will also be changes with regard to the way health data is handled. A general data law was being discussed, with particular focus on issues relating to big data. For example, patients could be given the opportunity, on a voluntary basis, to make their data available for research purposes. However, this also raises the question of why big data – a secondary use – should be regulated before the rules governing the use and exchange of basic data and its primary use in routine care have been clarified.

Major strategic gaps also exist with regard to telemedicine and mHealth. In Germany, there have been numerous successful telemedicine projects for years. However, the vast

530 BIO Deutschland, bitkom, bvitg, BVMed, SPECTARIS, VDGH, vfa, ZVEI. (2018). *Gemeinsames Diskussionspapier eHealth-Zielbild der Verbände.*

531 BearingPoint GmbH, Fraunhofer FOKUS. (2014). *eHealth – Planungsstudie Interoperabilität.* Bundesministerium für Gesundheit.

532 Gematik.de, (2018). Roadmap. [online] gematik. Available at: https://www.gematik.de/ausblick/roadmap/.

533 aerzteblatt.de (2018), *KBV will technische Standards für elektronische Patientenakten selbst entwickeln* [online] Ärzteblatt. Available at: https://www.aerzteblatt.de/nachrichten/97158/KBV-will-technische-Standards-fuer-elektronische-Patientenakten-selbst-entwickeln.

majority have been offered only regionally or in the context of selective contracts. Thus, patients have not been able to benefit on a nationwide basis. This raises the question of how strategies deemed to hold benefits can be scaled. mHealth remains the area with the greatest need for further clarification, especially with respect to mechanisms that might facilitate the transfer of applications into standard care.

Currently, the digital health discourse in Germany is strongly dominated by issues of liability and data-privacy protection. Actual opportunities to improve medical care through digitalization have consequently been pushed somewhat into the background. New strategies must also be debated in Germany, for example whether gematik as it currently functions is in a position to determine unified, binding standards on a nationwide basis, or whether the existing governance structures should instead be revised. The self-governing entities too need policymakers to create a legal basis for them to operate in some digital health areas.

The government has shown the political inclination to do so only recently; thus, its political statements have not yet translated into concrete action or produced on-the-ground results. In addition, the complexity of the current legal framework would also have to be reduced, a prospect which ultimately also does little to contribute to legal and thus planning certainty.

7.4.3 Recommendations for German digital health policy

The considerations, proposals and recommendations presented for discussion here reflect the empirical results both of the international benchmarking study and the five in-depth country analyses, against the background of developments in and the current state of the German digital health landscape.

Policy activities, strategy development and framework conditions

The analysis results – particularly the indicator-value levels shown by the countries classified by this report as most advanced with regard to the successful introduction of national or regional digital health systems and applications (Estonia, Canada, Denmark, Israel, Spain) – are highest in the “Policy activities, strategy development and framework conditions” area, in comparison to the other spheres of activity. In the holistic “Impact model for digitalization of the healthcare system,” these variables were combined under the concept of “digital health governance.” This encompasses the totality of the structures and processes associated with the implementation of digital health, including strategies and laws, the institutional anchoring of digital health policies, and political leadership.

The results underscore the significant importance for any digital health strategy of a policy oriented to the needs and imperatives of the individual health system. This is particularly true for the implementation activities that result from such a strategy, especially in the legal, regulatory and organizational-structural realms.

Digital health as a core element of healthcare policy

For the German situation, it follows that health-policy objectives set at the political level and supported by the sector’s primary actors should be central requirements for the formulation of an eHealth policy. Digital health today is so diverse in its manifestations, can be implemented in such wide-ranging ways, and can be used so flexibly, that the use of ICT applications will certainly become a routine part of operations, just as in other economic sectors. It is therefore less a question of whether, but rather of how ICT can be successfully introduced so as to provide benefits for patients.

First of all, it is critical to maintain a consistent orientation toward the general objectives and particularly the specific priorities of the healthcare policy, such as:

- Increasing patient safety
- Improving the quality of care
- Ensuring adequate care, particularly in rural areas
- Increasing cost efficiency and optimizing resource allocations
- Improving the public healthcare sector, including in problematic areas such as antibiotics resistance, the new appearance of contagious diseases, and the ability to combat chronic diseases and the consequences of societal aging
- Supporting medical and pharmaceutical research.

Large amounts of data and information are created in all policy and operational areas every day. Using this as a basis, and by continuously making correlations within such data, new knowledge and directives for medical experts and for healthcare policy are derived on an ongoing basis. It therefore makes sense to strive for the further development of a "learning health system" as a key aspect of the overall mission statement.

However, as the results of the analysis also show, some requirements remain to be fulfilled in order to achieve this.

Strategies for digitalization of the health system

The criterion of the relevance of "effective" strategies shows the strongest effect for the successful countries. Digitalization is a long-term, ongoing challenge that can be addressed only in stages, and which requires staying power. Strategies in successful regions and countries are characterized particularly by their initial focus on individual, well-prioritized services and the necessary associated infrastructure elements. Moreover, they specify the basic use cases in detail, so there are also clear guidelines for the implementation phase.

The prospect of improving patient safety through the use of digital health mechanisms has played a significant role since the beginning. In Germany, 5 percent to 10 percent of adverse events (AE), 2 percent to 4 percent of avoidable adverse events (AAE), 1 percent of treatment failures and 0.1 percent of mortalities (about 20,000 deaths per year) occur within the hospital sector alone.[534] Drug-therapy safety (DTS),[535] including the prevention of undesired side effects and potentially even fatal drug interactions, plays an important role in minimizing such events. The fact is, for example, that many physicians are not informed about the prescriptions issued by their other colleagues, which means they cannot recognize preventable adverse interactions or even mortality risks.

In Germany, some application options were proposed as the electronic health card was being conceived. However, the underlying use cases were generally not discussed or determined in sufficient detail with all stakeholders. Against the background of the experiences in successful countries, and also in the context of European harmonization efforts, it seems

534 Aktionsbündnis Patientensicherheit. *APS-Weißbuch Patientensicherheit 2018.* Witten: 2018.

535 Drug Commission of the German Medical Association (AkdÄ). "DTS is the entirety of measures aimed at ensuring an optimal medication process, with the goal of minimizing medication errors and the associated preventable risks for patients engaged in drug-based therapy." http://www.ap-amts.de/

advisable to focus initially on key, relatively quickly implementable use cases – for example, an electronic patient summary of particularly relevant general patient data – while keeping this closely tied to the introduction of an ePrescription service. As information regarding the drugs actually being consumed is more relevant for treating physicians than information on what has been prescribed, the ePrescription service could in turn be connected with an electronic feedback function from pharmacies proving detail on the medications that are actually picked up (eDispensation).

However, with regard to current political priorities such as ensuring adequate care levels in rural areas, parallel concrete considerations would also be conceivable, for instance regarding the use of existing infrastructure by creating telemedicine tools tailored to specific problems.

Switzerland case study: Because digitalization efforts in Switzerland generally take place on a regional or cantonal basis, but data exchange is also expected on a cross-cantonal basis, the eHealth Strategy 2.0 sets out detailed measures for an interoperable digital health system. In addition, using a first draft law as a basis, the probable economic impact of a national electronic patient dossier (EPD) system was evaluated in advance. This process found a positive influence on the quality of care. "In the context of the strategy, absolutely central principles were laid down that could not be called into question in the future course of events."[536]

Portugal case study: The Portuguese national digital health strategy, the National Strategy for the Health Information Ecosystem 2020 (ENESIS 2020) from 2016, is dedicated to improving the efficiency of the entire health system through the use of digital applications. In addition, there is a combined strategy for fulfilling general healthcare-policy goals with the help of key digital applications. On the political level, digital health efforts are strongly supported by the health minister. The SPMS digital health agency, which is affiliated with the Health Ministry, also implements European projects effectively at the national level. The SPMS also bears strategic responsibility for telemedicine services and applications, mHealth, and the Portuguese platform for healthcare data, while additionally pursuing self-selected objectives relating to implementation in these areas.

Denmark case study: Denmark has some experience with digitalization strategies. As a result, the current strategy includes concrete initiatives linked with actions and appropriate budget allocations. The difference with previous strategies rests precisely in this more concrete approach, which is comparable with an action plan. This is because the Danes too have learned that a strategy alone is not sufficient. In the past, strategies were often laid out sketchily, like general visons or roadmaps, and the planned projects were simply discussed and modified for as long as needed until they fit into the strategy. The current strategy involves an actual design framework with specific guidelines and objectives, as well as associated budget allotments for specific actions.

As experiences in other countries show, however, this alone is not enough for success. Additional framework conditions and factors must be in place.

536 Study trip interview

Legal framework and regulation

The strategies in particularly successful countries indicate that the secondary use of already-collected data by other users (e.g., other care providers or healthcare researchers) is an important element of a good digital health system. However, this requires an ethics framework to be in place, along with stringent laws or guidelines for data protection and IT security, among other issues. This is particularly true for the downstream transfer of healthcare data, access to such data, and the analysis and utilization of such data in secondary-use contexts. Such regulations should certainly be issued at the general level, but should also take account of the underlying use cases and the users involved. As an overall rule, general principles should be specified in the form of laws, while details should be handled in regulations that can be adapted more quickly to changed conditions.

Netherlands case study: One important question in this context is whether for each patient, an electronic health record with previously specified data (in summary or more extensive form) is to be automatically created, which can then be exchanged with or accessed by other care providers. This approach is referred to as the "opt-out model," as the patient has the ability to block creation of such a record. The alternative "opt-in model" allows such data to be made available only with the patient's express consent, which could be difficult for severely ill elderly people, for example.

In the Netherlands, the opt-out model was originally introduced, which led to conditions in which more than 80 percent of Dutch households were connected to the national EHR system. The data-privacy concerns that were then expressed, and which led to the cancellation of this project, did not reflect the position of the general population. Rather, they were the result of a year-long political conflict in the senate, the country's second national parliamentary chamber. Afterward, the opt-in option was introduced. However, this had the consequence that few phy sicians or patients use the current digital offering, primarily because they are not well informed regarding its potential. Experiences in Australia too indicate that if the opt-in option is chosen, it can be very difficult to obtain the participation of enough patients. This means that the various network effects produced when the data is available on the most widespread possible basis are not achieved. For example, the effort of searching winds up being much too great for the treating physician if many records contain no data, or records simply don't exist for many patients.

Switzerland case study: Switzerland is characterized by a complex constellation of actors and a strongly federalist system. Nevertheless, after many years of discussion, all actors involved were successfully able to achieve broad consensus regarding the contents and intended use of electronic records, as well as the next implementation steps. This enabled the adoption of the Act on Electronic Health Records (a patient summary – EPDG). This in turn created the conditions for the rapid implementation of electronic patient dossiers, which are now expected by the end of 2019.

Financing and incentives

Digital health is a long-term undertaking that has no specific endpoint, because medical practices, technical developments and the organizational-structural environment are subject to continuous change and further development. As a result, it logically follows that the resources necessary to sustain such efforts, particularly from a financial standpoint, must be made available on an adequate and sustainable basis. Successful countries establish a reliable financing foundation rather than depending on project-based funding. This report also shows examples of how the implementation of successive pilot projects ("pilotitis") has led only to the squandering of public or health-system funds. Accordingly, policymakers must ensure there are sufficient resources available for the organizational-technical construction of the digital infrastructure, its ongoing maintenance, and if necessary some financial compensation for care providers' use of applications (as a lump sum or on a per use basis).

In addition, financial incentives to promote the swift introduction or use of centralized/regional data-exchange platform(s), as well as cross-provider data-access or data-exchange services, for example, may also be useful.

The justification of this from a political point of view is seen in the fact that an eHealth platform provides greater benefits the more that – and the faster that – care providers and patients actually use its services. Once a critical mass has been achieved, innovation incentives of this kind are no longer necessary.

Organizational infrastructure and digital health agencies

The sustainable establishment and implementation of digital health systems requires an appropriately authorized institution with sufficient powers. This should be an organizational unit that holds overall responsibility for the establishment, management and maintenance of the digital health platform and its infrastructure services. Depending on the national situation, this entity may have to work closely and cooperatively with other specialized organizations. Within the governmental sphere, these may be bodies dealing with cyber-security issues, for example, or specialized national/regional organizations for the management of electronic identities for citizens, physicians and other health professions. Whether the entity takes the form of a department within a ministry, an independent eHealth institute or a department in a national health agency appears to be of secondary importance.

In Germany, gematik is responsible for only a limited portion of these tasks. It is establishing "the secure, cross-sectoral digital networking of the healthcare sector. It bears overall responsibility for the telematics infrastructure (TI) and coordinates operation of the TI. As a service provider for the leading organizations within the healthcare sector, it is the national-level center of competence in these areas."[537] Other tasks relevant in this context, such as those relating to the supply and maintenance of semantic dictionaries and classifications, rest with the German Institute of Medical Documentation and Information (DIMDI), whose task it is "to provide information from the entire field of medicine and its peripheral areas."[538] It appears that it would be useful to establish an eHealth institution with extensive powers in Germany too.

537 Gematik.de, (2018). *Über Uns.* [online] gematik. Available at: https://www.gematik.de/ueber-uns/
538 Dimdi.de, (2018). *Aufgaben.* [online] DIMDI. Available at: https://www.dimdi.de/dynamic/de/das-dimdi/aufgaben/

Denmark case study: The overall management of the healthcare system is centralized. However, decisions regarding administrative and specific organizational details take place at the regional and municipal levels. In this regard, regional structures do not appear as a barrier. Rather, the implementation of digital measures is left to the regions – under the supervision of the national MedCom agency, which sets the standards for cross-sectoral data exchange and use, and creates interoperability standards. As a national platform, Sundhed.dk works proactively with hospitals, visiting them in order to speak with clinic personnel, gain experience and create awareness of the system. It actively seeks to respond to and redress criticisms by its own members (the regions).

Netherlands case study: In the Netherlands, one response to the ongoing stagnation with regard to digital health developments has been MedMij, a system currently under development. The goal of MedMij is to facilitate the seamless exchange of medical information, comparable with the infrastructure used by ATMs. An ATM establishes its connection with a service provider in a global system, thus enabling a request to be forwarded to the correct bank. This service provider is the hub in the network that exchanges all the payment information between the bank, the retailer and the customer in a standardized and secure way. MedMij intends to translate this principle into the healthcare sector. It intends to allow patients to use a secure connection to communicate with a physician, a pharmacist, a hospital or any other healthcare service provider. MedMij is committed to letting citizens easily and securely gather, supplement and share their healthcare data with other healthcare service providers, for example in the context of an app or website. MediMij itself is a joint venture that includes insurance companies, the government, NICTIZ, the umbrella organization of healthcare service providers, and the leadership of the Dutch patients' association. The standards for MedMij were developed by NICTIZ.

Consensus and trust

Some regional and national healthcare systems – and even cooperative-like care providers such as health maintenance organizations (HMOs; see the Israel case study) – are characterized by the fact that virtually all primary-care services and hospitals are affiliated with the state or the cooperative. Moreover, the physicians are salaried in this case, and funding is provided from the national budget or the cooperative's contributions. This is quite conducive to digitalization on a nationwide scale, because costs, like the benefits of digitalization, apply to the entire system, and there are no individual winners or losers with parochial interests and business models.

In contrast, the model seen in many countries in which the healthcare sector is financed through health insurance providers, each of which is an independent actor (the so-called Bismarck model), creates an extremely complicated structure. In such circumstances, it is crucial to develop a trust- and consensus-based collaboration between all state and private actors in planning and implementing digital health systems. Only then can strategic and implementation questions alike lead in a consensual and transparent way, with open consideration of all relevant interests, to a mutually agreed-upon solution. This particularly applies to agreement regarding use cases for digital health applications such as ePrescription services, as well as the user-related details underlying their implementation.

In comparison with many other countries, this appears to be a particularly sensitive point in Germany. This aspect should be one of the most urgent tasks for the eHealth institution proposed above. We recommend that a general committee – or alternately a separate committee for each application.– be established immediately. This entity should be furnished with an appropriate governance framework and implementation capabilities (including the ability to make decisions in an appropriate time frame), as well as the necessary resources. This would allow the conflicting interests of the actors in the German healthcare system to be balanced in such a way that implementation of a digital health agenda would no longer be hindered by unresolved or contradictory use and implementation issues. It is neither ethically justifiable nor easily explained to the public that patient safety is being endangered, for example, because physicians are not sufficiently informed about or cognizant of the medications being prescribed by their colleagues.

Denmark case study: Denmark was an early leader in Europe with regard to introducing digital healthcare applications. A number of factors were conducive to this in Denmark, including the country's liberal attitudes toward modernization and technology; its cultural, political and economic equality; a political culture characterized by dialogue, pragmatism and a willingness to compromise; and a high degree of popular trust in the state and the system. Moreover, Denmark as a whole is also highly digitalized, and the Danish population's degree of knowledge about and willingness to use digital services are both especially high.

In Denmark, anthropologists and other specialists were employed to determine patients' and physicians' expectations of digital health solutions, with the help of focus-group interviews. In this regard, it turned out that continuity in care in particular represented a key missing element for patients. On the basis of this insight, among others, there was interest in developing the system further. At the beginning, the developers had attempted to digitalize all paper-based procedures, for example. However, this resulted in questionable outcomes, and produced little in the way of usable results. The cooperation with end users, particularly the physicians, prompted the system's creators to develop solutions for this problem.

Netherlands case study: A newly created healthcare information council will act as a coordination body between the ministry and the most important actors, in order to improve the previously rather weak cooperation between stakeholders. It is to be expected that the voluntary participation of the parties involved, along with the desire to make progress, will gradually lead to resolutions that are binding for all.

France case study: In France, the problem is that central implementation mechanisms are not successful when end users are not sufficiently integrated into the process, and thus do not participate. This country's process has a top-down character, in which everything is regulated and introduced by the central government. The DMP was introduced as a pilot project in 2004, but was brought into nationwide operation only in 2011. However, it subsequently faded even more quickly from view, as it had hardly any active users or patients. Primary factors in this failure included a lack of user-friendliness and a lack of local support for healthcare providers.

Frameworks and timetables for planning and implementation

This report has often noted that clear guidelines, frameworks and timetables for the specification and implementation of digital health applications are beneficial. Appropriate project-management mechanisms should of course be employed in Germany as well. However, this means that the requirements and tasks described in the previous sections must be addressed successfully in advance.

Change management and competence-building

The implementation of digital health strategies in some countries has been delayed or even undermined to the point of failure because "change management" efforts, including support for digital literacy and human-resources development, have been insufficient or minimal. This is often a sorely neglected success factor as national eHealth strategies are implemented.

In order to accelerate the implementation of a newly conceived eHealth policy, and to ensure eHealth solutions in Germany are used on a broad scale, digital literacy among care providers such as physicians, nursing staffers and other medical professionals, as well as among citizens and patients, must be further developed and expanded.

This will also have to include the planning of corresponding capacities in the proposed German digital health institution. Indeed, comprehensive digital health-related implementation-management mechanisms must be established in this entity. Professional change-management functions will be essential in order to facilitate a smooth process of transition from one digital health environment to another.

Spain case example: In the Andalusia, Valencia and Basque Country regions, the share of structured and coded data that is based on terminological standards and is digitally documented by a physician ranges between 25 percent and 50 percent. However, because more than 75 percent of all Spanish healthcare institutions should have already introduced formally established standards, training courses regularly take place aimed at sensitizing healthcare staffers to this issue and improving data quality.

Technical requirements for successful implementation

A key aspect of all national digital health systems is the ability to access and exchange healthcare-system data, along with its downstream use, processing and analysis.

In order to avoid unnecessary planning failures and costs associated with a pure digital health technology push, it is crucial to realize that accessing and exchanging data are not ends in themselves. Rather, such processes should always be designed with an eye toward benefits for the recipient of the data with regard to being better able to treat patients, benefits for the patients themselves, or benefits for those engaging in secondary use. Moreover, if no benefit whatsoever accrues to the originator of the data, this entity must be compensated for the costs associated with providing and transferring the data. If the benefits are ultimately not situated with individual actors, but rather provide advantage to the system as a whole, then the associated costs must be distributed accordingly across that system.

If data and information is exchanged between actors that use different IT systems, interoperability will be an issue of critical importance for the functionality of the overall system. This situation is a given in practically all countries surveyed here, even if individual regions within some countries (e.g., in Spain and Sweden) have implemented a single, fully integrated IT system for all healthcare actors.

In this regard, it is not enough simply to exchange data between technical systems. Rather, the participating healthcare organizations and people must understand the data, and must be able to process it usefully for their intended purposes. The solution to these interoperability issues constitutes the heart of every successful national and regional digital health infrastructure, and of the applications based upon them.

This in turn implies that interoperability questions cannot be solved simply through the use of general standards, dictionaries or abstract regulation; rather, what is needed is use-focused analyses of specific scenarios (use cases) and the solutions and specifications for all relevant parameters derived from them. Each specific use context must be identified – and for each, a variety of questions and details must be discussed, and a solution found that is supported by all involved parties.

Developments in countries such as the Netherlands, Austria and Switzerland have illustrated this situation quite well. At the same time, they show how the focus on only a few key use cases for the national-level exchange of data – such as electronic patient summaries, ePrescriptions, letters of discharge, and so on – can result in the successful implementation of strategic plans. Over a 15-year period, for example, the Netherlands had a disappointing experience in which the development of technical interoperability and the exchange of electronic documents equivalent to their paper counterparts did not produce the desired success. Only in the last two years have national digital health efforts swung toward the development of clinical data models (structures, formats, standardized measurements, semantic coding).

Switzerland has also shown itself to be very receptive to this *building blocks* approach, with mutual exchange between *eHealth Suisse* and the Dutch NICTIZ, for example. The full value and benefit of such a fully interoperable infrastructure becomes obvious and comprehensible only when the data-model specifications and requirements of all software systems can be represented, and the data to be exchanged can be transferred automatically into these models.

Important here is the observation that while international standards can indeed be useful for these activities, they frequently lack precision, and are sometimes even contradictory. Denmark too is increasingly relying on an approach based on clinical information models, and often considers standards to be of secondary importance, or even as being too constraining. In order to lead to a genuinely full interoperability in a specific use case, standards should be further specified within the specific national context. In this process, normally permitted alternatives should be excluded, and any semantic definitions still lacking should be added.

Austria and Switzerland have both gone down this path, which has included the production of very detailed technical, structural and – where useful and necessary – semantic specifications for all the information to be exchanged. In doing so, Austria has oriented itself strongly toward individual use cases, the associated data profiles, and message-exchange specifications, following the course laid out years ago by the *Integrating the Healthcare Enterprise* (IHE) association. Strict provisions regarding data security, cyber security, access rights, authentication, access logging and other challenges complement these national regulations and agreements.

For Germany, these observations produce a number of transferable strategy recommendations at the technical level.

1. First, the top-priority use cases (e.g., electronic patient summaries or full records, ePrescriptions, laboratory results, letters of discharge) should be defined, with all their various aspects described in a standardized way, as there can be no generalized solution to interoperability issues in the healthcare sector for the reasons already stated.
2. For each generic use case, the necessary information and data must be defined in a detailed and precise manner.
3. It must be determined whether this will be exchanged in the form of a simple text or document, a strictly structured document, or in part or as a whole as fully standardized and codified data. Depending on the downstream use of the data and the costs involved, very different solutions to the interoperability issues are both conceivable and potentially useful.

If this takes place using a transparent procedure, and a binding national-level agreement for Germany is reached with the cooperative participation of all key actors, the subsequent technical and regulatory implementation should no longer present insurmountable hurdles.

It should be specified whether the data will be made available on a centralized, decentralized or linked basis, and whether it should be available at any time or only upon individual request. A purely regionally oriented platform solution is also conceivable (given that healthcare is primarily a regional rather than a nationally oriented service). Such regional solutions could then be connected easily together through the use of the same information-processing mechanisms, based to the greatest degree possible on open specifications and data models.

7.5 Concluding remarks

The German healthcare system – often referred to as the "Bismarck system" – is characterized by the presence of self-governing organizations and a strong tradition of corporatism. These principles are rooted in decisions made over a century ago that have created a path dependency, or tradition, that is unique in Europe, if not the entire world. Among Germany's other equally formative and distinctive characteristics are the monopoly held by the Association of Statutory Health Insurance Physicians, the special structures involved in healthcare provision and the multiple actors, associations and bodies that unavoidably shape this form of joint self-governance.

The reasons for Germany lagging behind in terms of of the digital transformation of its healthcare sector are often sought in the mutual blocking of efforts and sclerotic nature of self-governance. Germany's healthcare sector is also characterized by self-imposed regulatory restrictions, such as the long-standing ban on exclusive remote treatments, the so-called remote prescription ban, and extremely high security demands on the telematics infrastructure, at least in international comparison. Our study shows that several European and other Western countries are significantly more advanced than Germany in the application and use of electronic health records, electronic physician-patient communication and other aspects of digital health. This advanced state of affairs is common not only to the Nordic countries, as one would expect, but also to countries such as Portugal and Spain. In these two countries, the state of digitalization is significantly more developed than in the German healthcare sector, which also happens to be one of the most expensive systems in Europe, not least in international comparison.

Drawing on our analysis of the (relatively) successfully digitalized countries, it can be argued that what Germany needs going forward is committed political action, resolute leadership underpinned by a vision that is shared by all actors, and a clearly defined implementation strategy. Instead of introducing measures and necessary standards “from above,” any action taken should be developed with the help and involvement of experts and – above all – end users. In order to ensure the success of an inclusive process, it would be fitting to establish an entity in the form of a digital health institute with the organizational and political power to issue binding requirements.

With regard to specific healthcare applications, Germany would be wise to look to other countries as role models and focus initially on two use cases that could be implemented relatively quickly: an electronic patient summary containing particularly relevant patient data and the introduction of ePrescriptions, which would be connected to patient summaries and the planned “eMedikationsplan.” “So-called electronic patient summaries are in use today in most countries; they also allow patient data to be exchanged relatively easily nationwide and across all sectors.” In this regard, Germany can draw upon a foundation, for example, in the form of its emergency dataset (Notfalldatensatz) and emergency data management (NFDM). In fact, if we examine these in detail, they meet the international definitional requirements of a patient summary. In this sense, the emergency dataset could act as the basis for further use cases independently of the electronic health record.

In order to account for the important role played by self-governance actors, individual patient-summary systems could be developed for Germany’s nationwide statutory health insurance funds. After that, by involving all relevant stakeholders, it would be possible to define a master dataset at the national level in the form of a patient summary, so that core data would also be available across all statutory health insurance funds in the case of an emergency. Given the emergence of standalone solutions in each statutory health insurance fund, such a pragmatic approach would facilitate the conditions needed to realize the EHR, which is supposed to be implemented by 2021.

In the short term, this strategic focus on individual use cases should not be burdened with other demands and expectations. In the middle term – that is, when the benefits have become apparent to all stakeholders and when all participants have similarly positive experiences – it would then be possible to implement further applications that much more quickly.

Annex

References

1177.se, (2018). *Om 1177 Vårdguiden.* [online] Available at: https://www.1177.se/Om-1177/Om-1177/

aerzteblatt.de, (2018) *Fehlendes Wissen und Finanzierungslücken bremsen Digitalisierung in Gesundheitswirtschaft aus.* [online] Ärzteblatt. Available at: https://www.aerzteblatt.de/nachrichten/96686/Fehlendes-Wissen-und-Finanzierungsluecken-bremsen-Digitalisierung-in-Gesundheitswirtschaft-aus

aerzteblatt.de, (2018) *KBV will technische Standards für elektronische Patientenakten selbst entwickeln* [online] Ärzteblatt. Available at: https://www.aerzteblatt.de/nachrichten/97158/KBV-will-technische-Standards-fuer-elektronische-Patientenakten-selbst-entwickeln.

aerztezeitung.de, (2018). *Neuer Abteilungsleiter für Digitalisierung.* [online] ÄrzteZeitung. Available at: https://www.aerztezeitung.de/praxis_wirtschaft/e-health/article/960508/bundesgesundheitsministerium-neuer-abteilungsleiter-digitalisierung.html

aerztebblatt.de, (2018). *Spahn will Patientendaten auf Handys und Tablets zugänglich machen.* [online] Ärzteblatt. Available at: https://www.aerzteblatt.de/nachrichten/96492/Spahn-will-Patientendaten-auf-Handys-und-Tablets-zugaenglich-machen

Aktionsbündnis Patientensicherheit, (2018). *APS-Weißbuch Patientensicherheit* 2018. Witten.

ameli.fr, (2018). *Notre histoire.* [online] Available at: https://assurance-maladie.ameli.fr/qui-sommes-nous/notre-histoire/histoire

Ammenwerth, E., Lannig, p., Hörbst, A., and Schnell-Inderst, P. (2017). Adult Patient Access to Electronic Health Records (Protocol). *Cochrane Database of Systematic Reviews,* [online] Vol. 2017, 6. Available at: http://cochranelibrary-wiley.com/doi/10.1002/14651858.CD012707/pdf

Anand, p. and Sen, A. (1994). *Human Development Index: Methodology and Measurement.* New York: UNDP.

Australian Digital-Health Agency, (2017). *Annual Report 2016-17.* Sydney.

Australian Medical Research Advisory Board, (2016). *Australian Medical Research and Innovation Strategy 2016-2021.*

autoriteitpersoonsgegevens.nl, (o.J.). *Mission vision and core values.* [online] Available at: https://autoriteitpersoonsgegevens.nl/en

bag.admin.ch, (2018). *Elektronische Identität.* [online] Bundesamt für Gesundheit, (BAG). Available at: https://www.bag.admin.ch/bag/de/home/themen/strategien-politik/nationale-gesundheitsstrategien/strategie-ehealth-schweiz/umsetzung-vollzug/elektronische-identitaet.html

Baller, p., Dutta, p., Lanvin, B. (2016). *The Global Information Technology Report 2016 – Innovating in the Digital Economy.* World Ecoonmic Forum. Geneva

Ballesteros, M. (2014). *Overview of the national laws on electronic health records in the EU Member States – National Report for Spain.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_spain_en.pdf

Bappert, J., Borck, M., Tigges, J. (2006). *Verwaltungsstrukturen in den Niederlanden.* WWU Münster. [online] Available at: https://www.uni-muenster.de/NiederlandeNet/nl-wissen/politik/vertiefung/verwaltungsstrukturen/rijk.html

Barkman, C., and Weinehall, L. (2017): Policymakers and mHealth: roles and expectations, with observations from Ethiopia, Ghana and Sweden. *Global Health Action,* 10 (3).

Bashshur R., Shannon G., Krupinski E. and Grigsby J. (2013). Sustaining and realizing the promise of telemedicine. *Telemed J E Health,* 19(5), p.339–345.

Beach, D. und Pedersem, R. (2016). *Caussal Case Study Methods.* Ann Arbor, Vereinigte Staaten: University of Michigan Press.

BearingPoint GmbH, Fraunhofer FOKUS. (2014). *eHealth – Planungsstudie Interoperabilität.* Bundesministerium für Gesundheit.

Benmeleh, Y. (2018). *Israel to Invest $275 Million in Digital Health Project.* [online] Bloomberg. Available at: https://www.bloomberg.com/news/articles/2018-03-25/israel-to-invest-275-million-in-digital-health-project

Bennet, A. und Checkel, J. (2014). *Process Tracing. From Metaphor to Analytic Tool.* Cambridge, Vereinigtes Königreich: Cambridge University Press.

Bergmo, T. (2015). How to Measure Costs and Benefits of eHealth Interventions: An Overview of Methods and Frameworks. *Journal of Medical Internet Research,* 17(11).

Berner Fachhochschule, (2017). *Konzept eLearning-Angebot zum elektronischen Patientendossier EPD. eLearning bei der Umsetzung des EPD.* [pdf] Bern. Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/170912_Konzept_eLearning-Angebot_EPD_def_d.pdf .

Bertelsmann Stiftung (2018): Spotlight Gesundheit. *Gesundheitsinfos.* Nr.2, 2018

Bewertungsausschuss. (2016). *Beschluss des Bewertungsausschusses nach § 87 Abs. 1 Satz 1 SGB V in seiner 386. Sitzung am 12. Dezember 2016 zur Änderung des Einheitlichen Bewertungsmaßstabes (EBM) 2016.* [pdf]

BIO Deutschland, bitkom, bvitg, BVMed, SPECTARIS, VDGH, vfa, ZVEI. (2018). *Gemeinsames Diskussionspapier eHealth-Zielbild der Verbände.*

Bmgf.gv.at, (2018). *E-Health/ELGA.* [online] Available at: https://www.bmgf.gv.at/home/Gesundheit/E-Health_Elga/Telemedizin/

Bo et al. (2014). National indicators of health literacy: ability to understand health information and to engage actively with healthcare providers – a population-based survey among Danish adults. *BMC Public Health,* 14, pp. 1095.

Bundesamt für Gesundheit, (2016). *Erläuterungen zur Verordnung über das elektronische Patientendossier (EPDV).* Bern.

Bundesamt für Gesundheit, (BAG), (2007). *Strategie „eHealth" Schweiz.* [pdf] Köniz: Bundesamt für Gesundheit. Available at: https://www.bag.admin.ch/bag/de/home/themen/strategien-politik/nationale-gesundheitsstrategien/strategie-ehealth-schweiz.html

Bundesamt für Kommunikation, (BAKOM), (2016). *Strategie Digitale Schweiz.* Biel.

Bundesärztekammer.de (2018). *Beschlussprotokoll. 121. Deutscher Ärztetag.* [pdf] 2018. Erfurt. Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=2ahUKEwjyrOrltercAhXI_KQKHb_UAXEQFjABegQICRAC&url=https%3A%2F%2Fwww.bundesaerztekammer.de%2Ffileadmin%2Fuser_upload%2Fdownloads%2Fpdf-Ordner%2F121.DAET%2F121_Beschlussprotokoll.pdf&usg=AOvVaw2D5r02NoeEt48_E8fI1fo0

Bundesärztekammer.de, (2018). *E-Health Gesetz.* [online] Bundesärztekammer. Available at: https://www.bundesaerztekammer.de/aerzte/telematiktelemedizin/earztausweis/e-health-gesetz/

Bundesministerium für Gesundheit, (2017). *Gesetzliche Krankenversicherung. Mitglieder, mitversicherte Angehörige und Krankenstand. Monatswerte Januar-Dezember 2016.* Berlin.

Bundesministerium für Gesundheit, (2014). *Empfehlungen und Bericht der Telegesundheits-dienste-Kommission gemäß § 8 BMG an die Frau Bundesministerin für Gesundheit.* Wien.

Bundesministerium für Gesundheit und Frauen (2017): *Gesundheitsziele Österreich. Richtungsweisende Vorschläge für ein gesünderes Österreich – Langfassung.* Wien.

Bundesregierung (2018). *Koalitionsvertrag zwischen CDU, CSU und SPD. Entwurf.* [pdf] Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwj0zsXFrtDcAhWI-6QKHZOEAksQFjAAegQIBRAC&url=https%3A%2F%2Fwww.proasyl.de%2Fwp-content%2Fuploads%2F2015%2F12%2F2018-02-07-Koalitionsvertrag-Union-SPD.pdf&usg=AOvVaw3hLz734yMbEd_ffQwGmlGu

Canada Health Infoway, (2009). *2015: Advancing the Next Generation of Health Care in Canada.* Toronto: Canada Health Infoway.

Canada Health Infoway, (2013). *Opportunities for Action. A Pan-Canadian Digital-Health Strategic Plan.* Toronto: Canada Health Infoway.

Canada Health Infoway, (2016). *Digital-Health Blueprint. Enabling Coordinated & Collaborative Health Care.* Toronto: Canada Health Infoway.

Canada Health Infoway, (2018). *PrecribeIT: Canada's Electronic Prescription Service.* [pdf] Toronto: Canada health Infoway. Available at: https://www.prescribeit.ca/component/edocman/140-prescribeit-backgrounder/view-document?Itemid=0 .

Canada Health Infoway, (2018). *Year in Review 2016-2017.* Toronto: Canada Health Infoway.

Canadian Medical Association, (CMA), (2017). *CMA Workforce Survey 2017. National Results by FP/GP or Other Specialist, Gender, Age, and Province/Territory.* [pdf] Ottawa: Canadian Medical Association. Available at: http://cma.andornot.com/SurveyPDF/CMA_Survey_Workforce2017_Q23_ElectronicToolsUsed-e.pdf .

Canadian Trade Commissioner Service, (2014): *E-Health and Telehealth Sector Profile – Stockholm, Sweden.* [pdf] Available at: http://www.bioalberta.com/uploads/files/Documents/Other%20Reports/E-Health%20and%20Telehealth%20Sector%20Profile.pdf.

Charmaz, K. (2010). *Constructing grounded theory. A practical guide through qualitative analysis.* Los Angeles, Kalifornien: Sage Publications Ltd.

Chevreul, K. Berg Brigham, K. Durand-Zaleski, I. Hernández-Quevedo, C. (2015). France: Health system review. *Health Systems in Transition,* 17(3), pp. 1–218.

Christ, C. Frankenberger, R. (2016). *Auf dem Weg zu Wohlfahrt 4.0 – Digitalisierung in Frankreich. Politik für Europa – 2017 plus.* Friedrich-Ebert-Striftung. Bonn.

Christiansen, T. (2012). Ten years of structural reforms in Danish healthcare. Health Policy, 106(2), pp. 114-119. doi:10.1016/j.healthpol.2012.03.019

Cirre, P. (2015). *e-Health: strategy and ongoing programs.* [online] Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/ev_20151123_co06_en.pdf

clalit-global.co.il (2018). *The Story of Clalit Health Services.* [online] Available at: http://www.clalit-global.co.il

clalit-global.co.il, (o.J.). *Clinics* [online] Clalit Available at: http://www.clalit-global.co.il/en/clinics.html

College bescherming persoonsgegeven (jetzt: Autoriteit Persoonsgegevens) (2013). *Toegang tot digitale patiëntendossiers binnen zorginstellingen.*

College bescherming persoonsgegeven (jetzt: Autoriteit Persoonsgegevens) (2014). *Onderzoek naar de toestemming voor de uitwisseling van medische persoonsgegevens via het Landelijk Schakelpunt.*

computable.nl, (2018). *Hoe staat het met het LSP?.* [online] Available at: https://www.computable.nl/artikel/achtergrond/magazine/5840508/5215853/hoe-staat-het-met-het-lsp.html

Cornet, R. (2017). *Infrastructure and Capacity Building for Semantic Interoperability in Healthcare in the Netherlands. Building capacity for health informatics in the future*, (234), pp. 70-74.

Cour des Comptes, (2018). Les services publics numériques en santé: des avancées à amplifier, une cohérence à organiser. Le rapport public annuel 2018 de la Cour des Comptes, p. 215-239.

Crounse, B. (2011). *World Class e-Health at Clalit Health Services in Israel.* [online] Available at: https://blogs.msdn.microsoft.com/healthblog/2011/05/02/world-class-e-health-at-clalit-health-services-in-israel/

csioz.gov.pl, (2018). *Rejestry medyczne.* [online] Centrum Systemow Informacyjnych: Ochrony Zdrowia. Available at: https://www.csioz.gov.pl/projekty/zrealizowane/rejestry-medyczne/.

CURAVIVA, (2014). *Strategie eHealth Suisse/ Elektron. Patientendossier. Ziele und Umsetzung – Erkenntnisse – Handlungsbedarf.* Bern. [pdf]. Available at: https://www.curaviva.ch/files/R3VJU8A/Ziele-Umsetzung-Erkenntisse-und-Handlungsbedarf-von-eHealth.pdf

DAK.de, (2018). *Jahresarbeitsentgeldgrenze.* [online] DAK-Gesundheit. Available at: https://www.dak.de/dak/arbeitgeber/jahresarbeitsentgeltgrenze-1076326.html

Dänisches Außenministerium, (2006). *Dänische Themen. Das Politische System.* Kopenhagen.

Danish Government and Local Government Denmark and Danish Regions, (2013). *Making eHealth work: National Strategy for Digitisation of the Danish Healthcare Sector 2013-2017.* [pdf] Available at: http://sum.dk/~/media/Filer%20-%20Publikationer_i_pdf/2013/Making-ehealth-work/Making%20eHealth%20Work.pdf

Danish Government, Local Government Denmark and Danish Regions, (2016). *A Stronger and More Secure Digital Denmark: Digital Strategy 2016-2020.* [pdf] Copenhagen: Agency for Digitalisation. Available at: https://digst.dk/media/16165/ds_singlepage_uk_web.pdf

Danish Ministry of Health, (2012). *eHealth in Denmark – eHealth as part of a coherent Danish health care system.* Danish Ministry of Health, Copenhagen.

Danish Ministry of Health, Danish Ministry of Finance, Local Government Denmark and Danish Regions, (2018). *A Coherent and Trustworthy Health Network for All: Digital-Health Strategy 2018-2022* 1ste Aufl.ed. [pdf] Available at: https://www.sum.dk/~/media/Filer%20-%20Publikationer_i_pdf/English/2018/A-coherent-and-trustworthy-health-network-for-all-jan-2108/A-coherent-and-trustworthy-health-network-jan-2018.pdf

De Almeida Simoes, J., Figueiredo Augusto, G., Fronteira, I. and Hernandez-Quevedo, C. (2017). Portugal. Health system review. *Health Systems in Transition.* [online] Vol 2017 Nr. 19 (2), p. 150f. Available at: http://www.euro.who.int/___data/assets/pdf_file/0007/337471/HiT-Portugal.pdf

De Benito, E. (2017). *Solo cinco comunidades han interconectado la receta electrónica.* [online] El Pais. Available at: http://politica.elpais.com/politica/2017/02/23/actualidad/1487862351_447695.html.

De Bousingen, D. (2017). *Der schwierige Start für Hoffnungsträger Macron.* [online] Ärzte Zeitung. Available at: https://www.aerztezeitung.de/politik_gesellschaft/gesundheitspolitik_international/article/935708/machtwechsel-Elysee-schwieriger-start-macron.html

De Bousingen, D. (2017). *Gesundheitssystem vor radikalen Änderungen?* [online] Ärzte Zeitung. Available at: https://www.aerztezeitung.de/politik_gesellschaft/gesundheitspolitik_international/article/934072/wahlen-frankreich-gesundheitssystem-radikalen-aenderungen.html

De Pietro C, Camenzind P, Sturny I, Crivelli L, Edwards-Garavoglia S, Spranger A, Wittenbecher F, Quentin W. (2015). Switzerland: Health system review. *Health Systems in Transition.* 17(4):1–288.

Destatis.de (2018). *Gesundheitsausgaben.* [online] Statistisches Bundesamt. Available at: https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/Gesundheit/Gesundheitsausgaben/Gesundheitsausgaben.html digital.nhs.uk, (2018). *Deployment and utilisation progress data.* [online] NHS Digital. Available at: https://digital.nhs.uk/data-and-information/data-tools-and-services/tools-for-accessing-data/deployment-and-utilisation-progress-data.

digital.nhs.uk, (2018). *GP2GP.* [online] NHS Digital. Available at: https://digital.nhs.uk/services/gp2gp.

digital.nhs.uk, (2018). *Information standards and data collections (including extractions).* [online] NHS England. Available at: https://digital.nhs.uk/data-and-information/information-standards/information-standards-and-data-collections-including-extractions.

digital.nhs.uk, (2018). *SNOMED CT: Summary.* [online] NHS Digital. Available at: https://digital.nhs.uk/services/terminology-and-classifications/snomed-ct.

digital.nhs.uk, (2018). *Summary Care Records (SCR).* [online] NHS Digital. Available at: https://digital.nhs.uk/services/summary-care-records-scr.

Dimdi.de, (2018). *Aufgaben.* [online] DIMDI. Available at: https://www.dimdi.de/dynamic/de/das-dimdi/aufgaben/

Di Minco, L. (2017). *Italian eHealth Strategy Implementation.*

Digilugu.ee, (2018). *Patient Portal.* [online] Available at: https://www.digilugu.ee/login?locale=en .

digst.dk, (2017). *Årsrapport.* [pdf] Available at: https://digst.dk/media/16482/digitaliseringsstyrelsens-aarsraport-2017.pdf

digst.dk, (o.J.). *About the Agency for Digitisation.* [online] Available at: https://en.digst.dk/about-us/

Dillet, R. (2018). *France's Digital Minister Mounir Mahjoubi on upcoming digital policies.* [online] TechCrunsh. Available at: https://techcrunch.com/2018/01/30/frances-digital-minister-mounir-mahjoubi-on-upcoming-digital-policies/?guccounter=1

Dobrev, A., Rissi, C., Marti, M., Stroetmann, K.. (2011) *Regulierungsfolgenabschätzung zum Vorentwurf des Bundesgesetzes über das elektronische Patientendossier.* Bericht im Auftrag von Bundesamt für Gesundheit und Staatssekretariat für Wirtschaft. Bern. [pdf] Available at: https://www.bag.admin.ch/dam/bag/de/dokumente/nat-gesundheits strategien/strategie-ehealth/vernehmlassung-vorentwurf/schlussbericht-epdg.pdf.download.pdf/.pdf

easylearn.ch, (2015). *Neues e-Learning zum elektronischen Patientendossier (EPD) und wie Sie Ihr Spital daran anschliessen.* [online] Available at: http://www.easylearn.ch/news/641-sue-fuehren-sie-das-elektronische-patientendossier-epd-erfolgreich-ein.html

ec.europa.eu, (2012). *Digital Single Market: epSOS large scale pilot entering into operational mode!.* [online] European Commission. Available at: https://ec.europa.eu/digital-single-market/en/news/epsos-large-scale-pilot-entering-operational-mode.

ec.europa.eu, (2013). *Digital Single Market: epSOS achievements – now also in Portugal.* [online] Europäische Kommission. Available at: https://ec.europa.eu/digital-single-market/en/news/epsos-achievements-now-also-portugal

ec.europa.eu, (2017). *Digital Single Market: Cross-border digital prescription and patient data exchange are taking off.* [online] European Commission. Available at: https://ec.europa.eu/digital-single-market/en/news/cross-border-digital-prescription-and-patient-data-exchange-are-taking.

ec.europa.eu, (2018). *ROP 6 Regional Operational Programme for Małopolskie Voivodeship 2014-2020.* [online] European Commission. Available at: http://ec.europa.eu/regional__policy/en/atlas/programmes/2014-2020/poland/2014pl16m2op006

Eftimovska, E. (2014). *The Swedish e-Health Landscape Surrounding the SRQ Registry.* Stockholm: Karolinska Institute.

eGesundheit.nrw .de, (2018). *eGesundheit.nrw.* [online] ZTG Zentrum für Telematik und Telemedizin GmbH. Available at: https://egesundheit.nrw.de/

eHealth Belgium, (2018). *eHealth Platform Standards.* [online] Available at: https://www.ehealth.fgov.be/standards/kmehr/en

ehealthfrance.com, (o.J.). *eHealth France Alliance offizielle Webseite,* [online] Available at: http://ehealthfrance.com/

ehealth-in-hessen.de, (2018). *E-Health-Initiative Hessen.* [online] E-Health-Initiative Hessen. Available at: https://www.ehealth-in-hessen.de/Initiative

eHealth Initiative, (2007). Eine Kommunikations- und Informationsstrategie für ein modernes österreichisches Gesundheitswesen.

eHealth Suisse, (2015). *Austauschformat Elektronisches Impfdossier.* 2te Aufl. Bern. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180507_CDA-CH-VACD_de.pdf

eHealth Suisse, (2015). *EPD – Metadaten Definitionsprozess und erstes „Startset“.* [pdf] Bern. Available at: http://docplayer.org/22318270-Ehealth-suisse-epd-metadaten-definitionsprozess-und-erstes-startset.html

eHealth Suisse, (2015). *Project Report Cross Border eHealth Information Services.* [pdf] Liebefeld. Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/Project_report_CBeHIS_jan-june2017_-_HUG___HEG.pdf

eHealth Suisse, (2017). *Arbeitsgruppe „technisch-semantische Integration EPD“.* Bern. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/170413_AG-technisch-semantische-Integration-EPD_d.pdf

eHealth Suisse, (2017). *Leitfaden für Bildungsverantwortliche: eHealth Themen für Gesundheitsfachpersonen.* 2te Aufl. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/171213_eHealth-Leitfaden-fuer-Bildungsverantwortliche_d.pdf

eHealth Suisse, (2017). *Informationsbroschüre für die Bevölkerung. Meine Gesundheitsinfos. Meine Gesundheitsinfos. Zur richtigen Zeit am richtigen Ort.* [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/171219_EPD-Broschuere_Bevoelkerung_d.pdf

eHealth Suisse, (2018). *Erläuterungen zum Einführungsplan Elektronisches Patientendossier.* Bern. [pdf] Available at. https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180531_Erlaeuterungen_Einfuehrungsplan_d_def.pdf

eHealth Suisse, (2018). *Strategie eHealth Schweiz 2.0 2018-2022.* [pdf] eHealth Suisse Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180214_Strategie_eHealth_2.0_Version_Dialog_NGP_d.pdf

eHealth Suisse, (2018). *Bericht EPD-Projectathon 2017.* [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180328_Reportage_EPD-Projectathon-2017_d.pdf

Eijpe, L. Time.lex & Milieu Ltd. (2014). *Overview of the national laws on electronic health records in the EU Member States. National Report for the Netherlands.* Brussels.

elga.gv.at, (2018). *ELGA – Meine elektronische Gesundheitsakte.* [online] Available at: https://www.elga.gv.at/index.html .

elga.gv.at, (2018). *Technische Bausteine von ELGA.* [online] Available at: https://www.elga.gv.at/faq/technische-bausteine-von-elga/index.html .

emishealth.com, (2018). *The implementation of Open APIs in the UK health system.* [online] Available at: https://www.emishealth.com/thinking/the-implementation-of-open-apis-in-the-uk-health-system/.

empirica, (2010). *Country Brief: Netherlands. eHealth Strategies.* empirica, European Commission, Bonn/Brussels.

empirica, (2013). *Regulierungsfolgenabschätzung zum Entwurf des Bundesgesetzes über das elektronische Patientendossier.* Bern.

england.nhs.uk, (2018). *Blog: Raising the Standard in Digital Health.* [online] NHS England. Available at: https://www.england.nhs.uk/blog/raising-the-standard-in-digital-health/.

england.nhs.uk, (2018). *Local Digital Roadmaps.* [online] NHS England. Available at: https://www.england.nhs.uk/digitaltechnology/info-revolution/digital-roadmaps/.

england.nhs.uk, (2017). *News: NHS Digital launches e-nursing week campaign.* [online] NHS England. Available at: https://www.england.nhs.uk/2017/08/nhs-digital-launches-e-nursing-week-campaign/; and digital.nhs.uk, (2018). Nursing and NHS Digital [online] NHS England. Available at: https://digital.nhs.uk/about-nhs-digital/nursing-and-nhs-digital.

Entwurf eines Gesetzes für schnellere Termine und bessere Versorgung (Terminservice- und Versorgungsgesetz – TSVG) 2018

Essén Essén, A., Scandurra, I., Gerrits, R., Humphrey, G., Johansen, M., Kierkegaard, P., Koskinen, J, Liaw, p., Odeh, p., Ross, P. and Ancker, J. (2018). Patient Acces to Electronic Health Records: Differences Across Ten Countries. *Health Policy and Technology,* [online] 7 (1), p. 44-56. Available at: https://www.healthpolicyandtechnology.org/article/S2211-8837(17)30072-2/pdf .

e-tervis.ee, (2018). *Estonian e-Health Foundation.* [online] Available at: http://www.e-tervis.ee/index.php/en/2012-07-22-13-35-31/organization

e-tervis.ee, (2018). *Tervise ja Heaolu Infosüsteemide Keskus.* [online] Available at: http://pub.e-tervis.ee/

European Commission (2016). *Digital Agenda Key Indicators.* [online] Available at: https://digital-agenda-data.eu/datasets/digital_agenda_scoreboard_key_indicators/visualizations

European Health Parliament, (2018). *What's the future for health care in Europe?.* [online] healthcare.digital. Available at: https://www.healthcare.digital/single-post/2018/03/28/What%E2%80%99s-the-future-for-health-care-in-Europe?utm=candesic_website

EU H2020 Assess CT Project (2017). *ASSESS CT Recommendations.* [PDF]. Assess CT. Assessing SNOMED CT for Large Scale eHealth Deployments in the EU. Online Available at: http://assess-ct.eu/fileadmin/assess_ct/final_brochure/assessct_final_brochure.pdf

Eysenbach, G. (2001). What is e-health? *J Med Internet Res.* 3(2).

Fachhochschule Bern, (2017). *Konzept eLearning-Angebot zum elektronischen Patientendossier EPD.* Bern. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2017/D/170912_Konzept_eLearning-Angebot_EPD_def_d.pdf

fachportal.gematik.de, (2018). *Evaluationsgutachten zur Fachanwendung Versichertenstammdaten-Management (VSDM).* [online] gematik. Available at: https://fachportal.gematik.de/service/berichte/evaluationsgutachten-vsdm/

Fascicolosanitario.gov.it, (2018). *Agenzia per l'Italia Digitale: Fascicolo Sanitario Elettronico.* [online] Available at: https://www.fascicolosanitario.gov.it/fascicoli-regionali

Garcia-Armesto, p., Begoña Abadia-Taira, M., Hernandez-Quevedo, C. and Bernal-Delgado, E. (2010). Spain. Health system review. *Health Systems in Transition.* [online] Vol. 2010, 12 (4). Available at: http://www.euro.who.int/___data/assets/pdf_file/0004/128830/e94549.pdf

Gartner, Inc., (2018). *Connected Health Information in Canada: A Benefits Evaluation Study.* [pdf] Toronto: Canada Health Infoway. Available at:https://www.infoway-inforoute.ca/en/component/edocman/3510-connected-health-information-in-canada-a-benefits-evaluation-study/view-document?Itemid=101

GDK, Schweizerische Eidgenossenschaft, (2017). *Elektronisches Patientendossier – Aktivitäten in den Kantone,* Bern. [pdf] Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180508_Stand_eHealth_In_den_Kantonen_def_d.pdf

GDK, Schweizerische Eidgenossenschaft, (2017). *Rahmenvereinbarung über die Zusammenarbeit im Bereich „eHealth" („eHealth"-Vereinbarung).* Bern. [pdf] Available at:

https://www.gdk-cds.ch/fileadmin/docs/public/gdk/themen/ehealth/beschluesse/ehealth-rahmenvereinbarung_20111027_d_sign.pdf
Gematik. (2006). *Die Spezifikationen der elektronischen Gesundheitskarte.* [pdf] Berlin: gematik. Available at: http://www.dkgev.de/pdf/1200.pdf
Gematik.de, (2018): *Bekanntmachungen.* [online] gematik. Available at: https://www.gematik.de/aktuelles/bekanntmachungen/
Gematik.de, (2018). *Die Gremien der gematik.* [online] gematik. Available at: https://www.gematik.de/ueber-uns/gremien/
Gematik. (2018). *gematik-Brief.* [pdf] Berlin: gematik. Available at: https://www.gematik.de/presse/publikationen/
Gematik.de, (2018). *Kompetenzzentrum für das digitale deutsche Gesundheitswesen.* [online] Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH. Available at: https://www.gematik.de/ueber-uns/kompetenzen/
Gematik.de, (2018). *Roadmap.* [online] gematik. Available at: https://www.gematik.de/ausblick/roadmap/
Gematik.de, (2018). *Über Uns.* [online] gematik. Available at: https://www.gematik.de/ueber-uns/
Gemeinsamer Bundesausschuss, (2018). *Innovationsfonds, Förderbekanntmachung vom 08. April 2018.* [pdf] Available at: https://innovationsfonds.g-ba.de/downloads/media/9/2016-04-08_Foerderbekanntmachung_nF_offen.pdf
Germany Trade & Invest, (2018). *Israel beschließt Ausbauprogramm für digitale Gesundheit.* [online] Germany Trade & Invest offizielle Webseite. Available at: http://www.gtai.de/GTAI/Navigation/DE/Trade/Maerkte/suche,t=israel-beschliesst-ausbauprogramm-fuer-digitale-gesundheit,did=1917398.html
Gesetz für sichere digitale Kommunikation und Anwendungen im Gesundheitswesen (E-Health-Gesetz) 2015
Gesetz Nr. 429 über die Weiterverarbeitung von personenbezogenen Daten 2000.
Gesetz über das Informationssystem im Gesundheitswesen 2011.
gesundheit.gv.at, (2018). *GESUNDheit.gv.at: Öffentliches Gesundheitsportal Österreichs.* [online] Available at: https://www.gesundheit.gv.at/elga/inhalt
Gey, P und Schreiber, B. (2014). *Frankreich: Wird der Staat jetzt umgebaut? Gebietskörperschaften auf dem Prüfstand.* [pdf] Friedrich-Ebert-Stiftung. Available at: http://library.fes.de/pdf-files/id/10525.pdf
Giewald, J. (2018). *So wollen die Ärzte die Telemedizin in Deutschland ausbauen.* [online] Neue Osnabrücker Zeitung. Available at:https://www.noz.de/deutschland-welt/gut-zu-wissen/artikel/1172919/so-wollen-aerzte-die-telemedizin-in-deutschland-ausbauen
Goberno de Espana, Ministerio de Industria, Energía y Turismo, (2013). *Digital Agenda for Spain.* [pdf] Available at: http://www.agendadigital.gob.es/digital-agenda/Documents/digital-agenda-for-spain.pdf
Godeluck, p. (2017). *Le dossier médical partagé va enfin prendre son envol.* LesEchos.fr. [online] Available at:https://www.lesechos.fr/economie-france/social/0301297278476-le-dossier-medical-partage-va-enfin-prendre-son-envol-2153701.php.
gov.pl. (2018). *Prezentacja "Strategii Rozwoju e-Zdrowia w Polsce na lata 2018–2022".* [online] Ministerstwo Cyfryzacji. Available at: https://www.gov.pl/cyfryzacja/prezentacja-strategii-rozwoju-e-zdrowia-w-polsce-na-lata-2018-2022
gov.uk, (2018). *National Information Board: About.* [online] Available at: https://www.gov.uk/government/organisations/national-information-board/about
government.nl, (2015). *Government encouraging use of eHealth.* [online] Available at: https://www.government.nl/topics/ehealth/government-encouraging-use-of-ehealth

Hartlev, M. (2014). *Overview of the national laws on electronic health records in the EU Member States: National Report for Denmark.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_denmark_en.pdf

hauptverband.at, (2018). SV: *Hauptverband der österreichischen Sozialversicherungsträger.* [online] Available at: http://www.hauptverband.at/cdscontent/?contentid=10007.789193

health.belgium.be, (2016). *ReTam: LOINC.* [online] Available at: https://www.health.belgium.be/fr/terminologie-et-systemes-de-codes-loinc

health.gov.on.ca, (2018). *Ontario Ministry of Health and Long-term Care: About the Excellent Care for All Act.* [online] Available at: http://www.health.gov.on.ca/en/pro/programs/ecfa/legislation/act.aspx

HMSS Europe, (2016). Interview with Bas Van den Dungen, Director General of Curative Care at the Dutch Ministry of Health. [video]. Available at: https://www.youtube.com/watch?v=i8qzZQplfIA

himssinsights.eu, (2018). *Moving towards a holistic healthcare ecosystem.* [online] HIMSS Europe: Insights. Available at: http://www.himssinsights.eu/moving-towards-holistic-healthcare-ecosystem.

himssinsights.eu, (2018). *Prescriptions without Boundaries.* [online] HIMSS Europe: Insights. Available at:https://www.himssinsights.eu/prescriptions-without-boundaries.

hspm.org, (2018). *Poland: Health Systems in Transition (HiT) profile of Poland.* [online] The Health Systems and Policy Monitor. Available at: http://www.hspm.org/countries/poland27012013/livinghit.aspx?Section=2.8%20Regulation&Type=Section.

Hypponen, H., Gilstad, H., Faxvaag, A., and Brattheim, B. (2016). Comparability, Availability and Use of Medication eHealth Services in the Nordic Countries. *International Journal on Advances in Life Sciences,* Vol. 2016, 8 (1&2), p.112-121.

Hypponen, H., Kangas, M., Reponen, J., Nöhr, C., Villumsen, p., Koch, p., Hardardottir, G., Gilstad, H., Jerlvall, L., Pehrsson, T., Faxvaag, A., Andreassen, H., Brattheim, B., Vimarlund, V., and Kaipio, J. (2015). *Nordic eHealth Benchmarking – Status 2014.* 1ste Aufl. [pdf] Copenhagen: Nordic Council of Ministers. Available at: https://norden.diva-portal.org/smash/get/diva2:821230/FULLTEXT01.pdf

icthealth.nl, (2018). *Overheid stopt 3 miljoen euro in PGO voor elke Nederlander.* [online] ICT&Health. Available at: https://www.icthealth.nl/nieuws/overheid-stopt-3-miljoen-euro-in-pgo-voor-elke-nederlander/.

improvement.nhs.uk, (2018). *Guide to special measures.* [online] NHS Improvement. Available at: https://improvement.nhs.uk/resources/special-measures-guide-nhs-trusts-and-foundation-trusts/.

inera.se, (2018). *Nationella tjänsteplattformen och tjänstekontrakt.* [online] Available at: https://www.inera.se/digitalisering/infrastruktur/nationella-tjansteplattformen-och-tjanstekontrakt/.

informatieberaadzorg.nl, (o.J.). *Deelnemers.* [online] Available at: https://www.informatieberaadzorg.nl/over-het-informatieberaad/deelnemers

informatieberaadzorg.nl, (o.J.). *Open consultatie vanaf vandaag live!.*, [online] Available at:https://www.informatieberaadzorg.nl/actueel/nieuws/2018/6/19/open-consultatie-vanaf-vandaag-live

Istituto per la Vigilanza sulle Assicurazioni, (IVASS) (2016). *Analisi Trend Prodotti Assicurativi.* [pdf] Available at: https://www.ivass.it/consumatori/azioni-tutela/indagini-tematiche/documenti/digital_health_insurance.pdf .

Jakobsson, L., and Sobin, J. (2014): *eHealth development in Sweden: A study of prominent aspects and benefits from a multi-user perspective.* MD. KTH, School of Industrial Engineering and Management.

Joint Action to Support the eHealth network, (JASEHN), (2017). *EU State of play on patient access on eHealth data. Interim report.* JASEHN.

JASEHN, (2017). *EU state of play on patient access on eHealth data.* Vienna.
Jensen T.K. (1999) Dänemark: Berufspolitiker in einer egalitären politischen Kultur. Borchert J. (eds) *Politik als Beruf.* Reihe Europa- und Nordamerika-Studien, vol 5.
Kautsch, M., Licho,M., and Matuszak, N. (2016). Development of Publicly Funded eHealth in Poland: Barriers and Opportunities. *Economics & Sociology,* 9(3).
kbv.de, (2017). *Vergütung für Videosprechstunde geregelt – Start schon im April.* [online] Kassenärztliche Bundesvereinigung. Available at: http://www.kbv.de/html/1150_27150.php
kbv.de, (2018). *DMP DIABETES TYP 2.* [online] Kassenärztliche Bundevereinigung. Available at: http://www.kbv.de/html/8444.php
kbv.de, (2018). *Telematikinfrastruktur.* [online] Kassenärztliche Bundesvereinigung. Available at:http://www.kbv.de/html/telematikinfrastruktur.php
Kirchberger, C. (2014). *Overview of the national laws on electronic health records in the EU Member States – National Report for Sweden.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_sweden_en.pdf .
Kierkegaard, P. (2013). E-Prescription across Europe. *Health Technology,* 3(3), p. 205-219.
Klein, M. (2018). *Minister-Premiere bei der conhIT: Jens Spahn gründet Abteilung für Digitalisierung im BMG.* [online] eGovernment Computing. Available at: https://www.egovernment-computing.de/jens-spahn-gruendet-abteilung-fuer-digitalisierung-im-bmg-a-710233/ .
Koninklijke Nederlandsche Maatschappij tot bevordering der Geneeskunst, (2010). *Richtlijnen inzake het omgaan met medische gegevens.* [pdf] Available at: https://www.nvpc.nl/uploads/stand/64Richtlijnen_Omgaan_met_medische_gegevens.pdf
Krause, A. (2017). *Die Niederlande sind ein Land von Minderheiten.* [online] Tagesspiegel. Available at: https://causa.tagesspiegel.de/politik/wie-gefaehrlich-ist-der-niederlaendische-populismus/die-niederlande-sind-ein-land-von-minderheiten.html
Krijgsman, J., Zwinkels, I., van Lettow, B., de Jong, J., Out, K., Friele, R., and van Gennip, L. (2016). *English summary of eHealth monitor 2016, more than technology.* [pdf] Available at: https://www.nictiz.nl/wp-content/uploads/2018/04/ENG_infographic_eHealth-monitor_2016.pdf.
Kroneman, M. Boerma, W. van den Berg, M. Groenewegen, P. de Jong, J. van Ginneken, E. (2016). The Netherlands: health system review. *Health Systems in Transition,* 18(2), pp. 1–239.
Krüger-Brand, H. (2010). E-Health in Österreich: Pragmatischer Ansatz trägt Früchte. *Deutsches Ärzteblatt,* [online] Vol. 2010, Nr. 107(28-29). Available at: https://www.aerzteblatt.de/archiv/77592/E-Health-in-Oesterreich-Pragmatischer-Ansatz-traegt-Fruechte .
Krupsky, p. (2018). *Israel Approves $264 Million National Digital-Health Program.* [online] CTech. Available at: https://www.calcalistech.com/ctech/articles/0,7340,L-3734832,00.html .
kvb.de, (2018). *Fortbildungsangebot der KVB.* [online]. Kassenärztliche Vereinigung Bayern. Available at: https://www.kvb.de/service/fortbildung/
kvs-sachsen.de, (2018). *Diagnosenverschlüsserung nach ICD-10-GM.* [online] KVS:Kassenärztliche Vereinigung Sachsen. Available at: https://www.kvs-sachsen.de/mitglieder/abrechnung/diagnosenverschluesselung-nach-icd-10-gm/ .
Kwiatkowska, E. (2016): It Solutions for Healthcare System in Poland: In Search of Benchmarks in Various Economic Perspectives. *Economics & Sociology,* 9(3).
laegemiddelstyrelsen.dk, (2016). *About us.* [online] Available at: https://laegemiddelstyrelsen.dk/en/about/
Lang, A. & Mertes, A. (2011). E-Health Policy and Deployment Activities in Europe. *Telemedicine and e-Health.* 17 (4), pp. 262–268, DOI: 10.1089/tmj.2010.0174.

lang.meuhedet.co.il, (o.J.). *Welcome to Meuhedet Health Services.* [online] Meuhedet. Available at: http://lang.meuhedet.co.il/
Lau, F., Price, M., and Bassi, J. (2014). *Toward a Coordinated Electronic Health Records (EHR) Strategy for Canada:White Paper – Working Draft.* Victoria: University of Victoria.
Lepasepp, K., Matjus, M. and Haamer, M. (2014). *Overview of the national laws on electronic health records in the EU Member States. National Report for the Republic of Estonia.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_estonia_en.pdf
leumit.co.il, (o.J.). *About Leumit Health Services* [online] Leumit. Available at: https://www.leumit.co.il/eng/Useful/AboutLeumit/
liberties.eu, (2015). *Dutch Senate Skeptical of Electronic Health Records.* [online] Available at: https://www.liberties.eu/en/news/the-netherlands-electronic-health-records/3809
LOI n° 2017-1836 de financement de la sécurité sociale pour 2018(1) 2017.
Lykke, M. und Clement, K. (2014). *Shared medication record in general practice – A casestudy.* MD. Aalborg University.
mailiz.mssante.fr, (2018). MSSanté. [online] Available at: https://mailiz.mssante.fr/home
maccabi4u.co.il, (o.J.). *Our Healthcare System* [online] Maccabi Healthcare. Available at: https://www.maccabi4u.co.il/1781-he/Maccabi.aspx
medcom.dk. (o.J) medcom offizielle Webseite, [online] Available at: https://www.medcom.dk/medcom-in-english
medcom.dk , (o.J.). *Information om p-journal.* [online] Available at: http://medcom.dk/media/4372/p-journalbrochure.pdf
medcom.dk , (2018). *MedCom opkrævninger til kommunerne i 2018.* [online] Available at: https://www.medcom.dk/media/8475/medcom-opkraevninger-til-kommunerne-i-2018.pdf
medcom.dk, (2018). *MedCom opkrævninger til regionerne i 2018.* [online] Available at: https://www.medcom.dk/media/8476/medcom-opkraevninger-til-regionerne-i-2018.pdf
medcom.dk, (o.J.). *MedCom-finansiering.* [online] Available at: https://www.medcom.dk/om-medcom/medcom-finansiering
medcom.dk, (o.J.). medcom offizielle Webseite,[online] Available at: https://www.medcom.dk/medcom-in-english
medmij.nl, (o.J.). *Waarom MedMij?.* [online] Available at:https://www.medmij.nl/waarom-medmij-zorggebruikers
meinimpfungen.ch, (2018). *Der schweizerische elektronische Impfausweis.* [online] Stiftung Meinimpfungen. Available at: https://www.meineimpfungen.ch/about.html
Ministère de la santé, de la jeunesse, des sports et de la vie associative, (2016). *Modernisation des Etablissements de Sante.* Paris.
Ministère des Affaires sociales et de la Santé, (2016). *Stratégie nationale e-santé 2020.* Paris.
Ministero del la Salute, (2018). *Telemedicina: Linee di indirizzo nazionali.* [pdf] Available at: http://www.salute.gov.it/imgs/C_17_pubblicazioni_2129_allegato.pdf
Ministry for Social Equality, (2017). The Digital Israel National Initiative: The National Digital Program of the Government of Israel. Tel-Aviv.
Ministry of Economic Affairs (2016). *Digital Agenda for the Netherlands – Innovation, Trust, Accelaration.* [online] Available at: https://www.government.nl/binaries/government/documents/reports/2017/04/11/digital-agenda-for-the-netherlands-innovation-trust-acceleration/Digitale+Agenda+ENGELSE+VERSIE.pdf
Ministry of Economic Affairs and Communications, (2014). *Digital Agenda 2020 for Estonia.* 1set Aufl. [pdf] Available at: https://www.mkm.ee/sites/default/files/digital_agenda_2020_estonia_engf.pdf .
Ministry of Health (2017). *Digitisation and Health Data. Healthcare in Denmark – An Overview.* Indenrigs- og Sundhedsministeriet, København.

Ministry of Health, (2011). *The national eHealth Information Strategy. National context, state of implementation and best practices.* [pdf] Rome. Available at: http://www.salute.gov.it/imgs/C_17_pubblicazioni_1653_allegato.pdf .

Ministry of Health, (2018). *Creating a Healthy Future.*

Ministry of Health, (2018). *Creating a Healthy Future.* Israel.

Ministry of Health and Social Affairs, (2010). *National eHealth – the strategy for accessible and secure information in health and social care.* [pdf] Stockholm: Ministry of Health and Social Affairs. Available at: https://www.regeringen.se/contentassets/632b4d0579554 9bc98a45cc5321db1c8/national-ehealth---the-strategy-for-accessible-and-secure-information-in-health-and-social-care-s2011.023.

Ministry of Health and Social Affairs, (2016): *Vision for eHealth 2025 – common starting points for digitisation of social services and health care.* Stockholm.

Ministry of Health, Welfare and Sport (2006). *ICT in Dutch Healthcare An International Perspective,* The Hague.

Min-saude.pt, (2013). *PDS – Plataforma de Dados da Saúde: O que é a Plataforma de Dados da Saúde?.* [online] Available at: http://spms.min-saude.pt/2013/11/pds-plataforma-de-dados-da-saude/ .

Mistry H. (2012). Systematic review of studies of the cost-effectiveness of telemedicine and telecare. Changes in the economic evidence over twenty years. *J Telemed Telecare,* 18(1),S.1–6.

Moreira, G. (2014). *Overview of the national laws on electronic health records in the EU Member States. National Report for Portugal.* [pdf] Brussels: Milieu Ltd. and Time.lex Available at: https://ec.europa.eu/health/sites/health/files/ehealth/docs/laws_portugal_en.pdf.

National E-health Strategy Task Force, (2015). Estonian eHealth Strategy.

National Information Board, (2014). *Personalised Health and Care 2020: Using Data and Technology to Transform Outcomes for Patients and Citizens: A Framework for Action.* [pdf] Available at: https://www.digitalhealth.net/includes/images/news0254/PDF/0172_NHS_England_NIB_Report_WITH_ADDITIONAL_MATERIAL_S8.pdf.

Nederlands Juristen Comité voor de Mensenrechten, (2015). *Dutch Senate Skeptical of Electronic Health Records.* [online] Liberties. Available at: https://www.liberties.eu/en/news/the-netherlands-electronic-health-records/3809.

NHS England, (2014). *Five Year Forward Look.*

NHS England, (2015). *Technology Enabled Care Services: Resource for Commissioners.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2014/12/TECS_FinalDraft_0901.pdf.

NHS England, (2016). *The Forward View Into Action: Paper – free at the Point of Care Guidance for Developing Local Digital Roadmaps.* [pdf] Available at: https://www.england.nhs.uk/digitaltechnology-old/wp-content/uploads/sites/31/2016/11/develp-ldrs-guid.pdf.

NHS England, (2017). *Annual Report 2016/17.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2017/07/Annual-Report-Full_201617.pdf.

NHS England, (2017). *De-Identification Data Items.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2017/04/data-sets-in-scope-scci2210.pdf.

NHS England, (2017). *Framework for patient and public participation in specialised commissioning.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2017/01/specialised-participation-frmwrk.pdf.

NHS England, (2017). *NHS Digital Business Plan 2017/18.*

NHS England, (2018). *Corporate Document and Records Management Policy.* [pdf] Available at: https://www.england.nhs.uk/wp-content/uploads/2017/09/document-records-management-policy-v4.pdf.

nhs.uk, (2018). *Transforming Digital Health.* [online] NHS. Available at: https://www.nhs.uk/transformation/.

nhs.uk, (2018). *Your health and care records.* [online] NHS. Available at: https://www.nhs.uk/NHSEngland/thenhs/records/healthrecords/Pages/what_to_do.aspx.

nhsconfed.org, (2018). *NHS Confederation homepage.* [online] Available at: http://www.nhsconfed.org.

nictiz.nl, (2012). *National eHealth situation in the Netherlands: history, status, future.* [pdf] Available at: https://www.hisi.ie/resources/Dr%20Michiel%20Sprenger%20-%20Nictiz%20-%20National%20eHealth%20Netherlands.pdf.

nictiz.nl, (2018). *Medicatieproces.* [online] Nictiz. Available at: https://www.nictiz.nl/programmas/medicatieproces/NPCF, KNMG, ZN (2012). *Nationale Implementatieagenda e-health (nia).* [online] Available at: https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2012/06/07/nationale-implementatieagenda-e-health-nia/nationale-implementatieagenda-e-health-nia.pdf

NPCF, KNMG, ZN (2012). *NationaleImplementatieagendae-health (nia).* [pdf] Available at: https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2012/06/07/nationale-implementatieagenda-e-health-nia/nationale-implementatieagenda-e-health-nia.pdf

nrc.nl, (2010). *Senaat eist stop aanleg medische dossiers.* [online] Available at: https://www.nrc.nl/nieuws/2010/06/02/senaat-eist-stop-aanleg-medische-dossiers-11897632-a1045324

nvz-ziekenhuizen.nl, (2018). VIPP-programma. [online] NVZ. Available at: https://www.nvz-ziekenhuizen.nl/onderwerpen/vipp-programma

Oderkirk, J. (2016). Readiness of electronic health record systems to contribute to national health information and research. *OECD Health Working Papers No. 99.* Paris: OECD Publishing.

OECD/European Observatory on Health Systems and Policies (2017). *Denmark: Country Health Profile 2017,* OECD Publishing, Paris/European Observatory on Health Systems and Policies, Brussels.

Olejaz, M. Juul Nielsen, A. Rudkjøbing, A. Okkels Birk, H. Krasnik, A. Hernández-Quevedo, C. (2012). Denmark: Health system review. *Health Systems in Transition,* 14(2):1-192.

Organisation for Economic Co-operation and Development, (OECD) and Joint Research Centre, (JRC), (2008). *Handbook on Constructing Composite Indicators: Methodology and Users' Guide.* 1ste Aufl.[pdf] Paris: OECD Publications. Available at: http://www.oecd.org/sdd/42495745.pdf .

Organisation for Economic Co-operation and Development, (OECD), (2015). *Draft OECD Guide to Measuring ICTs in the Health Sector.*

Patient Data Act, Patientdatalag 2008.

Patientenrechtegesetz 2008.

Personal Health Information Protection Act 2004.

Pietro, C. D. and Francetic, I. (2018). E-health in Switzerland: The laborious adoption of the federal law on electronic health records (EHR) and health information exchange (HIE) networks. *Health Policy,* 122 (2), pp. 69-74.

Polityka Insight (2017). *Transforming eHealth into a political and economic advantag.* [pdf] Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwjvk7L-t9DcAhUHyKQKHXbrAPYQFjAAegQIABAC&url=http%3A%2F%2Fmichalboni.pl%2Fmboni%2Fwp-content%2Fuploads%2F2016%2F11%2FeHealth-report-06.03.pdf&usg=AOvVaw2jplLrshymyE3YKVhl6TjV.

Powles, J. (2018). *There is no social licence for My Health Record. Australians should reject it.* [online] The Guardian. Available at: https://www.theguardian.com/commentisfree/2018/jul/20/there-is-no-social-license-for-my-health-record-australians-should-reject-it?mc_cid=63ff9e7acc&mc_eid=3602cf366e.

Praxia Information Intelligence, and Gartner, Inc., (2011). *Telehealth Benefits and Adoption: Connecting People and Providers Across Canada.* [pdf] Toronto:Canada Health Infoway. Available at: https://livecare.ca/sites/default/files/telehealth_report_2010_en.pdf .

PriceWaterhouseCoopers, (PWC), (2010). *eHealth Service Platform Study.* Luxembourg Ministry of Health

Rabinovich, A. *ISRAEL – HealthCare IT Industry,* Jerusalem.

Rahmenvereinbarung über die Zusammenarbeit im Bereich eHealth (eHealth Vereinbarung) 2017.

regioner.dk, (o.J.). *Regional Denmark.* [online] Available at: http://regioner.dk/services/in-english/regional-denmark

Reiter, R. (2014). Regulierung des Gesundheitswesens. *Gesundheitspolitik Frankreich.* [online] Available at: http://www.bpb.de/politik/innenpolitik/gesundheitspolitik/177384/regulierung

Rijksarchief in België, (2016). *Digital Act: België zet een belangrijke stap vooruit op vlak van elektronische archivering.* [online] Available at: http://arch.arch.be/index.php?l=nl&m=nieuws&r=alle-nieuwsberichten&a=2016-10-27-digital-act-belgie-zet-een-belangrijke-stap-vooruit-op-vlak-van-elektronische-archivering .

RIZIV, (2018). *Elektronisch attesteren met eAttest.* [online] Available at: http://www.inami.fgov.be/nl/professionals/individuelezorgverleners/artsen/beroep/Paginas/elektronisch-attestern-eattest.aspx#.Wthaf38uCyp .

riziv.fgov.be, (2017). *MyCareNet: een centraal dienstenplatform op het web.* [online] Available at: http://www.riziv.fgov.be/nl/themas/zorgkwaliteit/e-gezondheid/Paginas/MyCareNet.aspx#.WthYrX8uCyp .

Rosen, B., Waitzberg, R. and Merkur, p. (2015). Israel – Health System review. *Health Systems in Transition.* Vol. 2015, 17 (6), p.1-212.

Ross, J., Stevenson, F., et al. (2016). Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update). *Implementation Science.* 11, DOI: 10.1186/s13012-016-0510-7.

Royal Dutch Medical Association (2010) *Richtlijnen inzake het omgaan met medische gegevens, Utrecht, (Guideline on processing of medical data.* [pdf] Available at: https://www.nvpc.nl/uploads/stand/64Richtlijnen_Omgaan_met_medische_gegevens.pdf

Saisana, M., and Tarantola, p. (2002). *Composite indicators: the art of mixing apples and oranges.* Ispra: Joint Research Center of the European Commission. Sowie Organisation for Economic Co-operation and Development, (OECD) and Joint Research Centre, (JRC), (2008).

Schimmelfenning, F. (2006). Prozessanalyse. In: Behnke, J. Gschwend, T., Schindler, D. und Schnapp, K.-U., Hg., *Methoden der Politikwissenschaft. Neuere qualitative und quantitative Analyseverfahren,* Baden-Baden, Deutschland: Nomos, p. 263-271.

Schmeida, M. McNeal, R. and Mossberger K. (2007). Policy Determinants Affect Telehealth Implementation. *Telemedicine and e-Health.* 13 (2), p. 100–107.

Schölkopf u. Pressel (2014). Das Gesundheitswesen im internationalen Vergleich. Gesundheitssystemvergleich und europäische Gesundheitspolitik. 2. Auflage, Berlin.

Schweizerische Konferenz der kantonalen Gesundheitsdirektorinnen und –direktoren, (GDK), (2018). *Elektronisches Patientendossier (EPD) – Aktivitäten in den Kantonen.* [pdf] Bern: Scweizerische Konferenz kantonalen Gesundheitsdirektorinnen und – direktoren (GDK). Available at: https://www.e-health-suisse.ch/fileadmin/user_upload/Dokumente/2018/D/180508_Stand_eHealth_In_den_Kantonen_def_d.pdf .

Serviços Partilhados do Ministério da Saúde (SPMS), (2017). *Estratégia TIC 2020: Estratégia para a transformação Digital na Administração Pública,* [pdf] Available at: https://tic.gov.pt/documents/CTIC_TIC2020_Estrategia_TIC.pdf .

Serviços Partilhados do Ministério da Saúde (SPMS), (2017). *Plano de Atividades Investimento e Orcamento de 2017.* Lissabon.

Siemens-Betriebskrankenkasse, (2018). *Statement: Erklärung: eGK, ePA, eGA, ePF Begriffs-verwirrung im digitalen Gesundheitswesen – über was reden die eigentlich?.* [online] krankenkassen-direkt. Available at: https://www.krankenkassen-direkt.de/news/pr/mitteilung.pl?id=1901912 skillsforhealth.org.uk, (2018). *Core Skills Frameworks.* [online] Skills for Health. Available at: http://www.skillsforhealth.org.uk/services/item/146-core-skills-training-framework.

smarthealth.nl, (2016). *MedMij zet eerste stap naar open persoonlijke zorgapps.* [online] Available at: https://www.smarthealth.nl/2016/12/22/medmij-zet-eerste-stap-naar-open-persoonlijke-zorgapps/

smarthealth.nl, (2017). *Verzekeraars willen MedMij-programma in praktijk gaan uitproberen.* [online] Available at: https://www.smarthealth.nl/2017/11/02/verzekeraars-medmij-proves-proof-of-concept/

solidarites-sante.gouv.fr, (2018). *Le programme Territoire de Soins Numérique – TSN.* [online] Available at: http://solidarites-sante.gouv.fr/systeme-de-sante-et-medico-social/e-sante/sih/tsn/article/le-programme-territoire-de-soins-numerique-tsn

spid.gov.it, (2018). *SPID: Sistema Pubblico di Identità Digitale.* [online] Available at: https://www.spid.gov.it/ .

spms.min-saude.pt, (2018). *SPMS – Serviços Partilhados do Ministério da Saúde.* [online] Available at: http://spms.min-saude.pt/a-spms/

Spronk, R (2008). *AORTA, the Dutch national infrastructure,* Haarlem, The Netherlands.

sst.dk, (2017). *About us.* [online] Available at: https://www.sst.dk/en/about-us

Statens Serum Institut (2013). *Making eHealth work – National Strategy for Digitalisation of the Danish Healthcare Sector 2013-2017.* SSI, The National eHealth Authority, Copenhagen.

Strategie des Bundesrates für eine Informationsgesellschaft in der Schweiz 1998.

Strauss, A. und Corbin, J. (1990). *Basics of Qualitative Research. Grounded Theory Procedures and Techniques.* London, Vereinigtes Königreich: Sage Publications Ltd.

Stroetmann, K., Jones, T., Dobrev A. and Stroetmann V. (2006). *eHealth is Worth it – The economic benefits of implemented eHealth solutions at ten European sites.* [online] Luxembourg: Office for Official Publications of the European Communities, p.56. Available at: http://www.ehealth-impact.org .

Styrelsen for Patientsikkerhed, (2017). *Citizen and Patient Involvement Strategy.* [pdf] Available at: https://stps.dk/en/publications/2017/citizen-and-patient-involvement-strategy/~/media/304D1E92CAFD4EC1ACC17A6755F2E282.ashx

sundhed.dk, (2016). *Strategi for sundhed.dk – 2016-18.* [pdf] Available at: https://www.sundhed.dk/content/cms/16/75816_sundheddk_strategirapport_2016_2018_web.pdf

sundhedsdatastyrelsen.dk., (o.J). Sundhedsdatastyrelsen Offizielle Webseite. [online] Available at: https://sundhedsdatastyrelsen.dk

sundhedsdatastyrelsen.dk, (2017). *Årsrapport 2016.* [pdf] Available at: https://sundhedsdatastyrelsen.dk/-/media/sds/filer/om-styrelsen/aarsrapport-sundhedsdatastyrelsen-2016.pdf?la=da

Tärnov, K. (2015). *Estonian eHealth Strategy.*

The Health Information System Act 2007. Government regulatory act of Health Information System 2008.

thelawreviews.co.uk, (2017). *Poland.* [online] The Law Reviews. Available at: https://thelawreviews.co.uk/chapter/1151294/poland.

ticsante.com, (2017). *Près de 260.000 DMP créés depuis le début de l'année 2017.* [online] Available at: https://www.ticsante.com/print_story.php?story=3735.

ticsante.com, (2018). *Nicolas Revel annonce la généralisation du DMP pour octobre 2018.* [online]: https://www.ticsante.com/Nicolas-Revel-annonce-la-generalisation-du-DMP-pour-octobre-2018-NS_3918.html.

Ticsante.com, (2018). *Medasys.* [online] Available at: http://www.ticsante.com/le-comite-strategique-du-numerique-en-sante-a-tenu-sa-premiere-reunion-NS_3364.html

Time.lex & Milieu Ltd., (2014). *Overview of the national laws on electronic health records in the EU Member States. National Report for the Netherlands.* Brussels.

Tk.de, (2018) *Übertragung der Abrechnungsdaten (1/5)* [online] Techniker Krankenkasse. Available at: https://www.tk.de/techniker/unternehmensseiten/elektronische-gesundheitsakte/uebertragung-abrechnungsdaten-2028836

TNS Opinion & Social; DG JUST; DG COMM (2015). *Special Eurobarometer 431 – Data Protection.* European Commission, Brussels.

Undhedsdatastyrelsen.dk, (o.J.). Undhedsdatastyrelsen offizielle Webseite, [online] Available at: https://sundhedsdatastyrelsen.dk

van der Grinten, T. (2006). *Zorgen om beleid. Over blijvende afhankelijkheden en veranderende bestuurlijke verhoudingen in de gezondheidszorg* [Worries about policy. About continuing dependencies and changing policy conditions in health care]. Rotterdam: Erasmus Universiteit.

Van de Voorde, C., Van den Heede, K., Obyn, C., Quentin, W., Geissler. A., Wittenbecher, F., Busse, R., Magnussen, J., Camaly, O., Devriese, p., Gerkens, p., Misplon, p., Neyt, M.and Mertens R. (2014). Conceptual framework for the reform of the Belgian hospital payment system. *KCE Reports* [online] Vol. 2014, 229, p. 92.

Vdek.com (2018). *Daten zum Gesundheitswesen: Versicherte.* [online] Verband der Ersatzkassen. Available at: https://www.vdek.com/presse/daten/b_versicherte.html [Abgerufen 03 Aug. 2018]

vecozo.nl, (o.J.). *Wie zijn wij.* [online] Available at: https://www.vecozo.nl/over-ons/Wie-zijn-wij/

Verordnung des Gesundheitsministers vom 9. November 2015 über Art, Umfang und Modelle der medizinischen Dokumentation und die Art ihrer Verarbeitung.

Verordnung über den Dateninhalt der an das Gesundheitsinformationssystem übermittelten Dokumente und die Bedingungen und Vorkehrungen für die Aufbewahrung dieser Dokumente 2008.

Vieira de Almeida & Associados, (2014). *Data Protection in Portugal: overview. Q&A.* Lissabon.

Vogel, W. (2005). *Informationen zur politischen Bildung – Frankreich. Charakteristika des politischen Systems.* Bundeszentrale für politische Bildung.

vzvz.nl, (2018). *VZVZ en het LSP.* [online] Available at: https://www.vzvz.nl/page/Zorgconsument/Links/Over-VZVZ/10-feiten-over-het-LSP

Weik, I., und Sauermann, p. (2016). Telemonitoring in Österreich. *Zeitschrift für Gesundheitspolitik,* [online] 3, p. 36-46. Available at: http://docplayer.org/60451165-Telemonitoring-in-oesterreich.html

Weinberg, M. (2018). *How e-health enters into the life of French people.* [online] Verlingue. Available at: https://www.verlingue.com/how-e-health-enters-into-the-lives-of-french-people/

weisse-liste.de, (2018). *Weisse Liste.* [online] Available at:https://www.weisse-liste.de/de/

World Health Organisation, (WHO), (2016). *From Innovation to Implementation – eHealth in the WHO European Regions.* Copenhagen: WHO Publications.

Zelmer, J., Ronchi, E., Hyppönnen, H., Lupiañez-Villanueva F., Codagnone, C., Nöhr, C., Fazzalari, A., Adler-Milstein, J. (2016). International Health IT Benchmarking: learning from cross-country comparisons. *Journal of the American Medical Informatics Association.* [online] Vol. 2016, 24,(2), p. 371-379. Available at: https://academic.oup.com/jamia/article/24/2/371/2631498

Zorginnovatieplatform, (ZIP), (2009). *Inspiratie voor innovatie, De visie van het Zorginnovatieplatform.* [pdf] Den Haag: Zorginnovatieplatform. Available at: https://www.zorgvoorinnoveren.nl/uploads/media/Visie_ZIP.pdf

zorgvoor2020.nl. Ict zorgt met u mee. [online] Available at: http://www.zorgvoor2020.nl/hoofdstuk/2/

Key definitions

The glossary describes key terms against the background of their use in the survey and in the study report. The explanations are based on documents by the EU Commission, WHO, OECD, Federal Ministry of Health and Consumer Protection, and from relevant EU projects as well as self-definitions. The aim is to achieve a better understanding – without any claim to being complete.

Big Data

Big data in health refers to large routinely or automatically collected datasets which are electronically captured and stored. It is reusable in the sense of multipurpose data and comprises the fusion and connection of existing databases for the purpose of improving health and health system performance. It does not refer to data collected for a specific study (EU DG Santé definition).

Clinical terminology guidelines

A set of terminological resources that can be implemented in software applications to represent clinically relevant information in a semantically structured form that can be used by automated applications. These codes represent explicit formal definitions of meaning and are based on a consensus of actual use by clinicians.

Digital Health

The term digital health may refer to ICT tools and services for health that are used by healthcare professionals, institutions and administrations as well as utilities which provide patients directly with services related to healthcare (epSOS definiton).

Electronic patient ID

This commonly refers to a unique number or chip card to electronically identify the patient (epSOS definition). Patient identification is necessary to correctly match a patient to an intended treatment and prevent harm due to potential mistreatment.

eDispensing

eDispensing is defined as the electronic retrieval of a prescription and the dispensing of the medicine to the patient as indicated in the corresponding ePrescription. Once the medicine has been dispensed, the dispenser is to report the dispensation information using the ePrescription software (epSOS definition).

ePrescription

ePrescription consists of electronic prescribing and electronic dispensing: ePrescribing is defined as the electronic prescribing of medicine with the use of software and the electronic transmission of said prescription data to a pharmacy where the medicine can then be dispensed. eDispensing is defined as the electronic retrieval of a prescription and the dispensing of the medicine to the patient as indicated in the corresponding ePrescription. Once the medicine has been dispensed, the dispenser is to report the dispensation information using the ePrescription software (epSOS defnition).

epSOS

EU project. *Smart Open Services for European Patients* (epSOS) focuses on electronic patient record systems and operates within a complex policy environment. The initial focus is on cross-border access to Patient Summary data sets and ePrescriptions. epSOS has been conceived of as a pilot project designed to take place on a large scale, initially involving 12 EU-Member States, but expanded to 25 participating nations during the course of the project.

Electronic health record (EHR)

EHR is a comprehensive medical and cross-institutional record or similar documentation of the past and present physical and mental state of health of an individual in electronic form. EHRs also provide for ready availability of these data for medical treatment and other closely related purposes. EHRs are real-time, patient-centered records that provide immediate and secure information to authorized users. EHRs typically contain a patient's medical history, diagnoses and treatment, medications, allergies, immunizations, as well as radiology images and laboratory results. A National EHR system is most-often implemented under the responsibility of a national health authority and will typically make a patient's medical history available to health professionals in healthcare institutions and provide linkages to related services such as pharmacies, laboratories, specialists, and emergency and medical imaging facilities (epSOS definition).

Electronic medical record (EMR)

Electronic medical records (EMRs) are digital versions of the paper charts in clinician offices, clinics, and hospitals. EMRs contain notes and information collected by and for the clinicians in that office, clinic, or hospital and are mostly used by providers for diagnosis and treatment.

Personal health records (PHR)

Personal health records (PHRs) contain the same types of information as EHRs – diagnoses, medications, immunizations, family medical histories, and provider contact information – but are designed to be set up, accessed and managed by patients. Patients can use PHRs to maintain and manage their health information in a private, secure and confidential environment. PHRs can include information from a variety of sources including clinicians, home monitoring devices and patients themselves (ONC definition). Some patient portals have functions equivalent to PHRs.

General Practitioner

A physician providing primary care or working as non-specialist in a community center setting.

Health Care Professional

A doctor of medicine, a nurse responsible for general care, a dental practitioner, a midwife or a pharmacist, or another professional exercising activities in the healthcare sector which are restricted to a regulated profession as defined in Article 3(1)(a) of Directive 2005/36/EC, or a person considered to be a health professional according to the legislation of the Member State of treatment (EU definition[539]).

Health Information Exchange network

Health Information Exchange (HIE) refers to the process of electronically transferring, or aggregating and enabling access to, patient health information and data across provider organisations. Exchange may take place between different types of entities – for example, e-transfer of patient data between ambulatory care providers or e-transfer of data at the regional level (OECD definition).

Health literacy

The US Patient Protection and Affordable Care Act of 2010 defines health literacy as the degree to which an individual has the capacity to obtain, communicate, process, and understand basic health information and services to make appropriate health decisions. Health literacy skills are those people use to realize their potential in health situations. They apply these skills either to make sense of health information and services or provide health information and services to others (CDCP[540] definition)

ICT

Information & Communication Technologies. In North America often referred to as 'Information Technology' (IT).

mHealth

mHealth (mobile health) is the use of mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and wireless devices, for medical and public health practice. mHealth applications include examples such as treatment adherence, community mobilisation, collecting community and clinical health data, wellness and self-care, chronic disease management, and remote patient monitoring (WHO).

Patient portal

There are two major concepts of patient portals. The healthcare-centered patient portals are national healthcare-related online applications that allow access to all or part of an electronic medical record (EMR) and personal health information (health record, test

539 EU: Article 3f) of Directive 2011/24/EU on the application of patients' rights in crossborder healthcare
540 US Centers for Desease Controle and Prevention.

results, prescriptions). They are typically owned and administered by national / regional healthcare institutions, authorities and bodies (this study is not interested in commercially funded sources). On the other side, health information portals provide general, non-personalised medical information on medications, treatments, illness, or chronic conditions, and inform patients about various healthcare or medical topics (own definition).

Patient summary

A patient summary (PS) is a concise clinical document that provides an electronic patient health data set applicable both for unexpected, as well as expected, healthcare contact. A patient summary is a standardized set of basic health data containing the following information, such as general information about the patient (e.g., name, birth date, gender, etc.), a medical summary consisting of the most important clinical patient data (e.g., allergies, current medical problems, medical implants, or major surgical procedures during the last six months), a list of the current medication including all prescribed medication that the patient is currently taking (based on epSOS definition). The clinical data are recorded, as they are now, during routine medical care in the Electronic Health Record (EHR). If the EHR System is well structured, and the physician has entered coded information correctly, the patient summary can be automatically constructed.

Semantic interoperability

Semantic interoperability refers to the ability of computer systems to transmit data with unambiguous shared meaning. Semantic interoperability is a requirement to enable machine computable logic inferencing knowledge discovery and data federation between information systems. It is therefore concerned not just with the packaging of data but the simultaneous transmission of the meaning with the data. This is accomplished by adding data about the data linking each data element to a controlled shared vocabulary.

Technical interoperability

Technical Interoperability is usually associated with hardware / software components, systems and platforms that enable machine-to-machine communication to take place. This kind of interoperability is often centered on (communication) protocols and the infrastructure needed for those protocols to operate (ETSI definition).

Telehealth

Telehealth is broader in definition than telemedicine as it includes computer-assisted telecommunications to support management, surveillance, literature and access to medical knowledge. (WHO definition)

Telemedicine

Telemedicine is the provision of healthcare services, through the use of ICT, in situations where the health professional and the patient (or two health professionals) are not in the same location. It involves the secure transmission of medical data and information, through text, sound, images or other forms needed for the prevention, diagnosis, treatment and follow-up of patients (EU Commission definition, COM(2008)689).

Indexes

Tables

Figures

Abbreviations

AgID	Agenzia per l’Italia digitale – Italian Digitalisation Agency
AORTA	Architecturen, Ontwerp, Realisatie, Toetsen van kwaliteit, Acceptatie – Dutch Health Information Infrastructure
AP	Autoriteit Persoonsgegevens – Dutch Data Protection Agency
ARS	Agence Régionale de Sante – Regional Health Agency in France
ASIP Santé	L’Agence Française de la Santé Numérique, ehemals: Agence des Systèmes d‘Information Partagés de Santé – French Digital Health Agency
BAG	Swiss Federal Office of Public Health
BIG-ID	Electronic health card for health professionals (physicians, pharmacists, health care assistants), which is required for the national register (BIG register) in the Netherlands
BIG-Register	Beroepen in de Individuele Gezondheidszorg Register – Dutch register for health professionals (doctors, pharmacists and nurses)
BIP	Gross Domestic Product
BKK	Company Health Insurance
BSN	Citizen Service Number (The Netherlands)
Carsat	Caisse d‘Assurance Retraite et de la Santé au Travail – French Pensions and Occupational Health Insurance
CDU	Christian Democratic Union (German political party)
CEF	The European Union’s financing mechanism to promote growth, innovation and competition
CeHis	Center för eHälsa i Samverkan – Swedish Centre for E-Health
CIBG	Centraal Informatiepunt Beroepen Gezondheidszorg – Implementing agency of the Dutch Ministry of Health, Social Affairs and Sport
CISNS	Consejo Interterritorial del Sistema Nacional de Salud – Interterritorial Council of the National Health System in Spain
CNAM	Caisse Nationale d‘Assurance Maladie – French National Health Insurance
CNAMTS	La Caisse Nationale de l‘Assurance Maladie des Travailleurs Salariés – French National Health Insurance Fund for Employees
CSIOZ	Centrum Systemów Informacyjnych Ochrony Zdrowia – National Centre for Health Information Systems in Poland
CSMF	Confédération des Syndicats Médicaux Français – French Doctors’ Union
CSNS	Le Comité Stratégique du Numérique en Santé – Strategic Committee for Digital Health in France

CSU	Christian Social Union in Bavaria (German political party)
DMP	Dossier Médical Partagé (formerly Dossier Médical Personnel) – French electronic patient record
DMP	Disease Management Program
DNG	Dialogue National Health Policy
DoHA	Department of Health and Ageing – Australian Ministry of Health
DP	Dossier Pharmaceutique – French Medication Record
DRG	Diagnosis Related Group
DSGVO	General Data Protection Regulation
DSP	Digital Signal Processor
E-Card	Electronic health insurance card (Austria)
EDI	Federal Department of Home Affairs
EFMI	European Federation for Medical Informatics
eGA	Electronic health record
eGK	Electronic health insurance card
EHCI	Euro Health Consumer Index
EHIF	Estonian Health Insurance Fund
EHR	Electronic Health Record – Electronic patient record
eID	Electronic identification card
EKG	Electrocardiogram
ELGA	Electronic health record (Austria)
eMessaging	Electronic messaging service
EMR	Electronic Medical Record
ENHIS	Estonian National Health Information System
ePA	Electronic patient record
EPD	Electronic patient dossier (Switzerland & The Netherlands)
EPDG	Federal law on the electronic patient dossier (Switzerland)
EPDV	Regulation on the electronic patient dossier (Switzerland)
ePF	Electronic patient compartment
epSOS	EU project: Smart Open Services for European Patients
E-Rezept	Electronic Prescription
E-Skills	Ability to use ICT
EU	European Union
FDHA	Federal Department of Home Affairs
FMH	Foederatio Medicorum Helveticorum – Federation of Swiss doctors
GCI	Global Competitiveness Index
GDK	Swiss Conference of Cantonal Health Directors
GDP	Gross Domestic Product
gematik	Society for Telematics Applications of the Health Insurance Card mbH
GKV	State-mandated health insurance
GMD	Global Medical Dossier
GP	General Practitioner
GT	Grounded Theory
HDI	Human Development Index
HL7	Health Level Seven International
HLS-EU	European Health Literacy Survey
HMO	Health Maintenance Organisation
HSA	Health and Healthcare Address Register (Sweden)
HSM	Highly Specialised Medicine
HTA	Health Technology Assessment

ICD-10	International statistical classification of diseases and related health problems – 10th revision
ICT	Information and Communication Technologies
IDI	Inclusive Development Index
IGZ	Inspectie voor de Gezondheidszorg – Dutch Health Inspectorate
IHE	Integrating the Healthcare Enterprise
IKT	Information and Communication Technology (ICT)
IMIA	International Medical Informatics Association
IT	Information Technology
IuK	Information und Kommunikation (Information and Communication)
JRC	Joint Research Centre of the European Commission
KI	Composite indicators
KNMG	Koninklijke Nederlandsche Maatschappij tot bevordering der Geneeskunst – Royal Medical Chamber in The Netherlands
KV	Associations of Statutory Health Insurance Physicians
LHV	Landelijke Huisartsen Vereniging – National Association of General Practitioners in The Netherlands
Loi HPST	„Hôpital, Patient, Santé et Territories“-Law
LOINC	Logical Observation Identifiers Names and Codes
LSP	Landelijke Schakelpunt – National Switching Point in The Netherlands
mHealth	Mobile Health
MHR	My Health Record – Australian electronic patient record
MPI	Master-Patient-Index (Switzerland)
MSA	Mutualité Sociale Agricole – Statutory health insurance fund in France which insures employees in the agricultural sector
MSSanté	French news service which enables doctor-to-doctor communication
NBoH	National Board of Health, Sundhedsstyrelsen
NemID	Danish log-in and authentication service for public digital services
NeRN	Nordic eHealth Research Network
NFZ	Narodowy Fundusz Zdrowia – National Health Fund in Poland
NHHRC	National Health and Hospital Reform Commission
NHIMAC	National Health Information Management Advisory Council
NHS	National Health Service
NIA	Nationale Implementatieagenda e-health – National implementation agenda for e-health in the Netherlands
NIB	National Information Board
NIC	Nationaal Intermutualistisch College – National Insurance Association in Belgium
Nictiz	Nationaal ICT Instituut in de Zorg – Dutch National Institute for ICT in Healthcare
NPCF	Nederlandse Patiënten Consumenten Federatie – Dutch Patients Association
NPÖ	Nationell Patientöversikt – Swedish Patient Summaries
NRI	Networked Readiness Index
NSIS	Nuovo Sistema Informativo Sanitario – National Health Information Network in Italy
NVZ	Nederlandse Vereniging van Ziekenhuizen – Dutch umbrella organisation of hospitals
OECD	Organisation for Economic Co-operation and Development
OFEK	Internal health information network of the Israeli health care provider Clalit
OKP	Compulsory health insurance (Switzerland)

PBS	Pharmaceutical Benefits Scheme
PC	Personal Computer
PCEHR	Personally Controlled eHealth Record
PCT	Primary Care Trust
PDS	Plataforma de Dados da Saúde – National Health Platform in Portugal
PKI	public-key infrastructure
PT	Process Tracing
PvdA	Partij van de Arbeid – Dutch Labour Party
RCU2	Resumo Clinico Único do Utente – Clinical patient summaries in Portugal
RIZIV	Rijksinstituut voor ziekte- en invaliditeitsverzekering – National Institute for Health and Disability Insurance in Belgium
RVS	Council for Public Health and Society
SCR	Summary Care Record
SGB	Social security statute book
SGMI	Swiss Society for Medical Informatics
SHA	Strategic Health Authority
SITHS	Electronic health identification system in Sweden
SITHS e-ID	Electronic ID to identify health professionals in Sweden
SKL	Sveriges Kommune och Landsting – Swedish Association of Municipalities and Regions
SMD	Secure Message Delivery
SPD	Social Democratic Party of Germany
SPID	Sistema Pubblico di Identità Digitale – Public system for digital identity in Italy
SPMS	Serviços Partilhados do Ministério da Saúde – Portuguese Digital Health Agency
SRQ	Svensk Reumatologis Kvalitetsregister – Swedish Quality Register for Rheumatology
SumEHR	Summarised Electronic Healthcare Record (Belgium)
SZW	Ministerie van Sociale Zaken en Werkgelegenheid – Dutch Ministry of Social Affairs and Employment
TEHIK	Tervise ja Heaolu Infosüsteemide Keskus – Centre for Health and Social Information Systems in Estonia
TGDK	Telehealth Commission
TSN	Programme Territoire de Soins Numérique – National Digital Health Promotion Programme in France
URCAM	Unions Régionales des Caisses d'Assurance Maladie – Regional health insurance association in France
UNCAM	Union Nationale des Caisses d'Assurance-Maladie – National health insurance association in France
UZI-Register	Unieke Zorgverlener Identificatie Register – Dutch identification register for healthcare providers
VIPP	Versnellingsprogramma Informatie-Uitwisseling Patiënt en Professional – Acceleration programme for data exchange between patients and healthcare professionals in the Netherlands
VVD	Volkspartij voor Vrijheid en Democratie – People's Party for Freedom and Democracy in the Netherlands
VWS	Ministerie van Volksgezondheid, Welzijn en Sport – Dutch Ministry of Public Health, Welfare and Sport

VZVZ	Vereniging van Zorgaanbieders voor Zorgcommunicatie – Association of health service providers for health communication in the Netherlands
WDH	Waarneem Dossier Huisartsen – Patient summaries in the Netherlands
WEF	World Economic Forum
WHO	World Health Organisation
ZAS	Central Compensation Office (Switzerland)
ZIP	Zorginnovatieplatform – Dutch internet platform for innovations in healthcare
ZN	Zorginstituut Nederland – Dutch internet platform for innovations in healthcare; Zorgverzekeraars Nederland – Dutch Health Insurance Association

Countries surveyed

AU	Australia
BE	Belgium
DK	Denmark
DE	Germany
EE	Estonia
FR	France
ISR	Israel
IT	Italy
CA	Canada
GB	United Kingdom (NHS England)
NL	Netherlands
AT	Austria
PL	Poland
PT	Portugal
SE	Sweden
CH	Switzerland
ES	Spain

Authors

Dr. Rainer Thiel
Lead Author
Head of ICT Innovation in Health
empirica Gesellschaft für Kommunikations- und Technologieforschung

Jonas Rennoch
Junior Consultant Digital Health Research and Policy
empirica Gesellschaft für Kommunikations- und Technologieforschung

Dr. Veli Stroetmann
Head of Digital Health Research and Policy
empirica Gesellschaft für Kommunikations- und Technologieforschung

Tobias Hüsing
Senior Consultant, Unit Digital Skills and Statistics empirica Gesellschaft für Kommunikations- und Technologieforschung

Daniel Schmidtmann
Junior Consultant, Unit ICT Innovation in Health empirica Gesellschaft für Kommunikations- und Technologieforschung

Dr. Karl Stroetmann
Senior Consultant, Unit Digital Health Research and Policy empirica Gesellschaft für Kommunikations- und Technologieforschung

Klaus Piesche
Consultant, Unit ICT Innovation in Health empirica Gesellschaft für Kommunikations- und Technologieforschung

Lucas Deimel
Junior Consultant, Unit Digital Health Research and Policy empirica Gesellschaft für Kommunikations- und Technologieforschung

Imprint

Bertelsmann Stiftung
Carl-Bertelsmann-Straße 256
33311 Gütersloh
Phone +49 5241 81-0
www.bertelsmann-stiftung.de

Responsible
Uwe Schwenk

Authors
Rainer Thiel,
Lucas Deimel,
Daniel Schmidtmann,
Klaus Piesche,
Tobias Hüsing,
Jonas Rennoch,
Veli Stroetmann,
Karl Stroetmann

Editing
Paul Katltefleiter

Translation
Barbara Serfozo

Design
Dietlind Ehlers

Adress | Contact

Bertelsmann Stiftung
Carl-Bertelsmann-Straße 256
33311 Gütersloh
Phone +49 5241 81-0

Dr. Thomas Kostera
Project Manager
Program Improving Healthcare – Informing Patients
Phone +49 5241 81-81204
Fax +49 5241 81-681204
thomas.kostera@bertelsmann-stiftung.de

www.bertelsmann-stiftung.de

BertelsmannStiftung