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A Comparative Analysis of the Australian and German eHealth System

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Abstract

The Australian and German healthcare system share extensive similarities in their financial and administrative structures. Both countries follow a two-tiered system offering both public and private insurance. As Germany adapted the Australian DRG system in 2003 to bill patients according to diagnosis-related case rates, patient treatment and accounting also follow similar practices. Despite their common preconditions in the “offline” setting, the goals and execution of their nationally initiated eHealth solutions show vast differences. While Australia’s platform-based My Health Record offers an opt-in solution for patients and doctors to exchange healthcare data under shared control between patient and service provider, Germany’s Electronic Health Card (EHC) mandatorily includes personal and insurance data that can be further expanded with medical data and electronic health records. Information on the EHC is mainly managed by healthcare providers. The differing approaches are linked to different opportunities and weaknesses. This paper provides a systematic overview of the Australian and German eHealth system and gives suggestions on strategies and challenges from both countries. By conducting a SWOT analysis, both eHealth systems are critically reflected considering supported processes, applied technologies, and user acceptance. We furthermore discuss the impact of the individual systems on current healthcare issues and the success rate of their initial intentions.

Keywords: eHealth, SWOT analysis, Germany, Australia, DRG, healthcare system, EHC, PCEHR

1 Introduction

The use of technology to increase efficiency and transparency in organisations has been widely accepted worldwide and transformed operations in many sectors, e.g. commerce, finance or education. In healthcare, the need for technological support is becoming even more prominent. Developed countries are suffering from increasing cost pressure and rising consumer expectations. The lack of trained professionals leads to an expanding need for more efficient communication and collaboration between healthcare professionals. Even though many countries already adopted information and communication technologies to support individual healthcare processes, a comprehensive solution and infrastructure for integrated healthcare processes has yet to be developed. The requirements for the success and a positive effect of eHealth strategies is threefold. Firstly, the acceptance and access of both providers and consumers, i.e. healthcare professionals and patients, highly influences the actual increase in efficiency and speed of adoption. Secondly, governmental support and legal requirements have to be established to determine how and which processes in the healthcare ecosystem can be improved or have to be adapted. The required technology and nationwide standards are lastly essential to facilitate the introduction of networked applications. The forecast for the development of the global digital health market shown in Figure 1 projects a continuous rise for eHealth applications worldwide, e.g. telehealth and electronic health records (Little, 2016). To support this steady growth and enable scalability throughout various eHealth application areas, national strategies for setting an eHealth vision and its implementation have been introduced by a majority of nations. Although healthcare systems in developed countries are confronted with similar issues, e.g. an aging population and increasing cost pressure, approaches of national eHealth solutions vary in their execution.

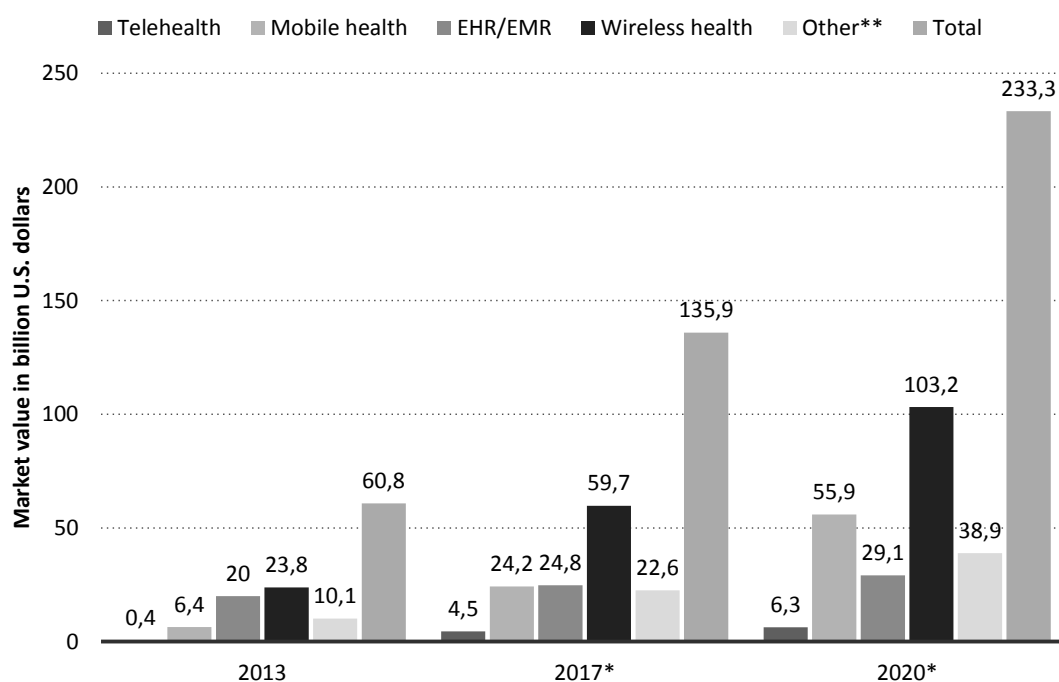


Figure 1: Global digital health market from 2013 to 2020, by segment (in billion U.S. dollars) (Little, 2016)

The aim of this paper is to identify strategies for the successful adoption of national eHealth projects, by comparing the Australian and German eHealth systems. While both countries' healthcare systems bear similar traits in the "offline" setting considering insurance and financial administration, the execution and goals of their nationally initiated eHealth solutions show vast differences. This contrast provides an interesting opportunity to detect challenges and implications of both approaches that can be used to find best practises, identify critical obstacles, and give suggestions for eHealth adaptations in other developed countries.

The paper is structured as follows: Section two gives an overview of the healthcare systems in Australia and Germany and relevant insights from eHealth research. In section three, both national eHealth strategies are analysed based on their macro-environmental factors, i.e. *Governmental and policy support*, *Technology and infrastructure* and *User access and accessibility*. Based on these findings, a SWOT analysis is conducted for both countries in section four, providing strategies for successful eHealth adoptions. The discussion in section five concludes with the results, implications and limitations of this paper.

2 Background

2.1 Healthcare Systems in Australia and Germany

Both Australia and Germany follow a universal two-tiered system, offering private and statutory health insurance. While public and private insurance can be taken complementary in Australia, Germany only allows one type of primary insurance and limits the transfer to the private system with a minimum required level of income. With health expenditures of 11.3 percent of the country's GDP Germany spends slightly more on healthcare compared to Australia's 9.4 percent (OECD, 2015). Both countries are also among the top rates in life expectancy and quality of care. Besides demographic similarities, hospital administration and billing follow similar approaches due to corresponding patient classification systems based on diagnosis related groups.

"Diagnosis related groups" (DRG) are admitted patient classification systems which provide a clinically meaningful way of relating a hospital's casemix to its required resources. Patients with similar clinical conditions requiring similar hospital resources are categorized in groups and priced accordingly (Fetter, Shin, Freeman, Averill, & Thompson, 1980). Initially originating in the US in 1980, the development of the Australian National DRG (AN-DRG) system began in 1988 and was released in July 1992. It is based on the US developed "All Patient Diagnosis Related Groups" (AP-DRG). The system has been renamed to Australian redefined DRG (AR-DRG) after introducing the ICD-10-AM diagnosis and procedure codes (Lüngen & Lauterbach, 2002). The current AR-DRG version 6.0 is mainly based on the seventh edition of ICD-10-AM, classifying patients based on major diagnostic categories (MDC), procedures medical conditions and other factors that differentiate processes of care (AIHW, 2016).

In 2003, Germany adapted the Australian DRG (diagnosis-related groups) system to bill patients according to diagnosis-related case rates. The goal behind this adaptation was to reduce variation in pricing and provide more efficiency and transparency of hospital services. As the AR-DRG system was not commercially bound, but managed by the Australian government, the choice of adopting it to the German healthcare system was mainly supported by the lack of licencing costs and international acceptance (Lüngen & Lauterbach, 2002). Since then, hospital costs for health

services have been reduced by 0.6 percent a year in Germany until 2012 with clear indication for this to be a result of the DRG implementation (Haeussler, Zich, & Bless, 2014). However, even with this increase in efficiency hospitals have suffered a funding gap of over 11 billion euro since 2004 due to continuously reduced compensation by health insurances. (Neumann, 2014). Since the implementation in 2003, the DRG system has undergone major revisions and changes from the first adaption of the Australian DRG system. The basis for the German DRG system relies on the ICD-10-GM, the international classification of diseases and health problems, and the OPS, the classification for operations and procedures (InEK GmbH, 2016).

2.2 eHealth

The rapid development of information and communications technologies in the past years has led to an increased usage of the internet and electronic devices to search, access and monitor health information, communicate with peers or health professionals and manage personal health records. This phenomenon termed eHealth has been broadly defined as the transfer of health resources and support of health care processes by electronic means. It comprises three main areas, i.e. the “delivery of *health information*, for health professionals and health consumers, through the Internet and telecommunications”, “using the power of IT and e-commerce to improve *public health services*” as well as “the use of e-commerce and e-business practices in *health systems management*” (WHO, 2016). According to the 5 “C’s” model by Eng (2001) the functions and capabilities of eHealth encompass *Content, Community, Commerce, Connectivity* and *Care*. Alongside these fields of eHealth, Eysenbach (2001) proposes ten characterizations for eHealth and its goals. The overall purpose of eHealth is the improvement of efficiency and enhancing quality of care by using evidence based methods and approaches. To improve community and connectivity, the empowerment of patients and the encouragement of better relationships between patient and health professionals is key. By providing online education for physicians and enabling information exchange and communication in a standardized way the scope of healthcare can be extended beyond its conventional boundaries. Ethical concerns arising through new methods of patient-physician interaction have to be considered and access and usage of eHealth has to be equitable to all populations.

Key to a successful use of eHealth technologies is the controlled access of information for relevant stakeholders. Although the concept of electronic medical records to store and share patient and treatment information, has already been implemented in some countries, including Australia and Germany, acceptance is not at a peak yet. Castillo et al (2010) identify six main issues for the adoption of electronic medical records comprising user attitude towards information systems, workflow impact, interoperability, technical support, communication among users, and expert support. This research shows that especially user acceptance and the technical infrastructure are vital to ensure successful eHealth operations. The framework for assessing eHealth preparedness proposed by Wickramasinghe et al. (2005) determines four main areas that influence a country’s eHealth potential, i.e. Information and Communication Technology Architecture and Infrastructure, Standardization, Policies, Protocols and Procedures, User Access and Accessibility Policies and Infrastructure and Governmental Regulations and Roles. Based on these prior findings, influencing aspects for a national eHealth strategy can be viewed according to macro-environmental aspects, i.e. political, economic, social, technological, legal and environmental factors (Kotler & Armstrong, 2010).

3 Comparison of eHealth systems

To enable successful eHealth development, the various motivations and perspectives of key stakeholders have to be considered. According to Eng (2001) major stakeholders can be categorized into consumers, application developers, clinicians, policymakers, health care organizations, public health professionals, employers, and purchasers. The interactions and decisions of these individual groups has a high impact on acceptance and enablement of eHealth initiatives. Furthermore, Boonstra et al (2010) identify eight critical factors for the adoption of electronic medical records including Financial, Technical, Time, Psychological, Social, Legal, Organizational, and Change Process. Hage et al. (2013) argue that eHealth only leads to sustainable adoption when the implementation carefully considers and aligns the eHealth content, the pre-existing structures in the context and the interventions in the implementation process. Successful eHealth implementation therefore relies on the infrastructural prerequisites and technical standards, governmental and policy support as well as user acceptance and accessibility. Based on these influencing areas, the following sections analyse the implementation, key challenges and opportunities of eHealth systems in Germany and Australia and develop suggestions with regards to their present experiences. Figure 2 summarizes the scope of eHealth and its influencing macro-environmental factors that are considered in our analysis.

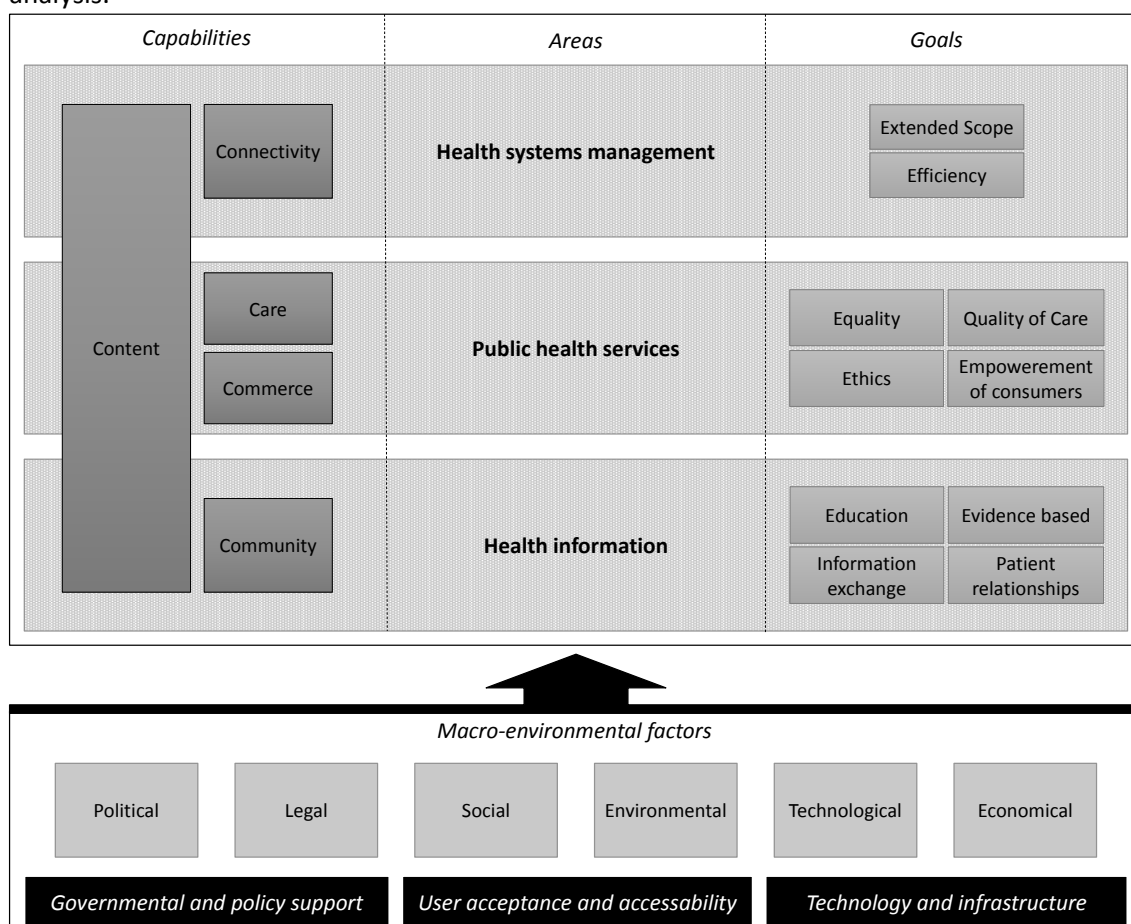


Figure 2: Scope of eHealth

3.1 eHealth in Australia

The Australian healthcare system is argued to be among the best providers of outstanding quality of care. In comparison to Germany, the unrestricted access to healthcare services is not as prominent, but the coordination of care shows overall better results (Davis et al., 2014). This stems from the early attempts on utilizing eHealth to increase transparency and efficiency in care, starting with the introduction of the eHealth technology program in 1991. Since then, the Australian eHealth strategy has been continuously refined and analysed to adapt to emerging issues in healthcare.

Governmental and policy support

In 2004-2005 the national eHealth transition authority (NEHTA) was established to develop the eHealth agenda with the development of eHealth standards, clinical terminologies and patient and provider identifiers. In 2008, the new Labour government asked consultants from Deloitte to help develop a new direction. They found that lack of financial support was one of the main problems. Three months after the submission of Deloitte's report, the government introduced its national eHealth strategy. This adoption strategy of eHealth in Australia was implemented incrementally following three main principles (Australian Health Ministers' Council, 2008):

- To leverage currently existing resources in the Australian eHealth landscape,
- To manage underlying variation in capacity across health sector and states and territories and
- To allow scope for change during the implementation process

In 2009 the National Health and Hospitals Reform Commission released a report advocating the introduction of personal electronic health records. In 2010-2012 the Personally Controlled EHealth Records (PCEHR) platform was founded and launched in July 2012. The objective behind this system was the establishment and operation of a voluntary national system for the provision of access to health information. The main goal of the PCEHR system was to improve availability and quality of health information and reduce fragmentation, minimize the occurrence of adverse medical events and duplication of treatment and support coordination of healthcare provided to consumers by different healthcare providers. Australia has passed a legislative framework that includes governance arrangements, a privacy and security framework and a registration regime or the My Health Record system (Australian Government, 2012). However, in contrast to Germany, Australia still lacks appropriate governance and regulatory mechanisms to manage, monitor and control the system.

Technology and infrastructure

Although Australia doesn't rank as high in international comparisons considering technology and R&D in general (Florida et al., 2011), the use of healthcare technologies has been developed. Similar to Germany's gematik, Australia's NEHTA is leading a national approach to develop a national eHealth infrastructure and IT standards to enable connected health. So far, a national terminology for medicines (AMT), a clinical terminology (SNOMED) and a secure message delivery system (SMD) were implemented as a first step for setting national standards. The goal is to build this foundations within the My Health Record platform as the national eHealth infrastructure.

Table 1 summarizes the main components of the PCEHR system, intended services and solutions and the underlying infrastructure.

Table 1: Australian eHealth infrastructure (Bunker, 2011)

Personally Controlled Electronic Health Record	Clinical Information	Individual Information	Shared Information	Others
eHealth Services	Shared Health Profile	Event Summaries	Self Managed Care	Complex Care Management
eHealth Solutions	eDiagnostics	eDischarge	eReferral	eMedications
National Infrastructure Components	Clinical Terminology & Information	Secure Messaging	Identifiers	Authentication

User access and accessibility

Up until today, only 11 percent of the Australian population are yet registered on the platform and just slightly over 8,000 healthcare provider organisations, mainly general practices (Australian Department of Health, 2015). Without legal enforcement to adapt the platform for e.g. billing or insurance claims, usage rates have not yet reached the lower limit for a comprehensive adoption of eHealth services. Due to the lack of meaningful use of the PCEHR system, the platform will be changed to an opt-out solution and renamed to My Health Record in 2016. A resulting wider uptake of the system is projected to increase the value for healthcare professionals, and consequently their willingness to use the system. Registration barriers for healthy persons or disadvantaged patients thus should be eliminated (Australian Department of Health, 2013).

Key Challenges

The aging population, increasing incidence of chronic disease, rising customer demand for more costly, complex and technologically advanced procedures and the simultaneous lack of skilled health sector workers are causing a major rise in cost and complexity for the Australian healthcare system. Pre-existing eHealth solutions to counter these issues are implemented as discrete islands of information with significant barriers to effective sharing of information between health care participants. Without proper national coordination, extensive service duplication, avoidable expenditures and solutions that cannot be scaled or integrated can drastically decrease the potential of eHealth. In addition, Australia still lacks the required legal and infrastructural foundations to enable a nationwide implementation of their eHealth platform.

3.2 eHealth in Germany

The German healthcare system is suffering from demographic change, increasing costs, and lack of skilled professionals. Telemedicine can help counter these problems (TeleHealth 2011) by improving treatment efficiency and quality, increasing access speed to relevant information and enables networking between all stakeholders of the care value chain. EHealth can support current issues regarding coordination, integration and networks between stakeholders and enhance decision making and planning throughout the entire value care chain.

Governmental and policy support

Until 2004, Germany offered a basic health insurance card (KVK) providing minimum information about a patient’s personal and insurance information as a credential for patients to claim health services. Due to limitations in storage and applications of this insurance card, the modernization act by the statutory health insurance in January 2004 proposed the extension of the insurance card to the electronic health card (EHC), which was finally implemented in early 2006. The goal behind the EHC was to provide health service providers access to patient information through IT to increase treatment quality, control health service processes and quality for medical treatments (GKV Spitzenverband, 2015a).

Since January 1st 2015, the “Electronic Health Card (EHC)” is the mandatory credential in Germany to claim services covered by the health insurance. Table 2 summarizes the required and optional information on the EHC with their respective legal codes.

Table 2: Required and optional information on the EHC

Information	Required/ Optional	Legal code
Name of the issuing health insurance	Required	SGB §291a (2) SGB §291 (2)
First and last name of the insurant		
Date of birth		
Sex		
Address		
Insurance number		
Insurance status		
Out-of-pocket payment		
Date of insurance commencement		
Date of expiration time (for fixed-term insurance)		
Medical prescriptions in electronic and machine-usable form		
Credential for health treatment in an EU/EEA member state		
Medical data	Optional	SGB §291a (3)
Medical reports		
Electronic patient record		
Additional data provided by the insurant		
Information and consent form on organ and tissue donation		
Information to verify drug therapy security		

Data security is provided by following a two-key-principle. Both an electronic healthcare ID by the professional and the personal healthcare card and PIN code of the patient is required to access their medical data. Although not yet implemented, the EHC is designed to include electronic patient records, medical reports, care records and medication records in the future.

Besides internal regulations and investments, Germany can additionally benefit from EU initiatives and funding schemes. The topic of health, demographic change and wellbeing addressed in the Horizon2020 program provides extensive funding possibilities for eHealth applications and development. The Digital Agenda for Europe focuses an entire pillar of their Europe 2020 strategy on ICT-enabled benefits for the EU society, including actions to enable secure online access to medical health data and a widespread telemedicine deployment (Action 75), define a minimum common set of patient data (Action 76), foster EU-wide standards, interoperability testing and certification of eHealth (Action 77) and reinforce the Ambient Assisted Living (AAL) Joint Programme (Action 78) (European Commission, 2015).

Technology and infrastructure

Germany is a leading country in technology development considering financial and human resources devoted to R&D as well as patents granted per capita (Florida et al., 2011). In healthcare, Germany currently ranks high considering quality of care, access to healthcare services, efficiency and equity as well as expenditure per capita. Especially access to healthcare shows above-average results in international comparisons. Space for improvement is still found in the area of coordinated care, which constitutes a major issue to be solved by eHealth (Davis, Stremikis, Squires, & Schoen, 2014).

Besides access to advanced technology, a main requirement for a successful national eHealth strategy is the underlying infrastructure to integrate applications and provide and access data in a structured and protected environment. For a strategical conception and implementation of the EHC and telematics infrastructure, the company for EHC telematics applications *gematik* was founded in Germany in 2005 (gematik, 2016). The company's core responsibility lies in managing the development, implementation and maintenance of a country-wide telematics infrastructure. Although first rollout was projected for mid-2015, security issues and the highly technical requirements for connecting hospitals, apothecaries, medical practices and care facilities throughout Germany are still delaying deployment. In December 2015, the German parliament passed a new legislation for secure digital communication and applications in healthcare, legally replacing the preceding health insurance card with the EHC. This legislation lays down a timeframe for a nationwide integration of hospitals and practices into the developed infrastructure until 2018 (Deutscher Bundestag, 2015).

User access and accessibility

From a professional standpoint, the eHealth acceptance rate in Germany shows a below-average increase on an EU level of 31 percent since 2007. While the country's Professional-to-Patient initiatives in telehealth, e.g. remote monitoring and consultation, show good results in international comparisons, the Professional-to-Professional dimension including online education and joint consultation is still lagging behind. The combination of a mandatory insurance proof and an optional extension for further information lowers the barriers of

adopting a new system for users. Since over 97 percent of the insured population is now provided with an EHC (GKV Spitzenverband, 2015b) the extension of additional services, e.g. electronic health records, can be added more easily to the already distributed systems. Issues with user participation for the basic system can therefore be eliminated, however the use of additional services could still be obstructed by user acceptance.

Key Challenges

Although the EHC was already implemented in 2006, an integrated, accessible and data security compliant infrastructure for telemedical services has yet to be developed. Through many regional projects, individual solutions have been brought up, that already exploit parts of what eHealth can offer, but further reinforce redundancies in development. Investments in healthcare structures and concepts are still scarce, leading to a pool of isolated applications within a diverse, fragmented market. Another issue obstructing eHealth development stems from the lagged development of IT standards in the healthcare sector and missing secure networks. Lack of investments, scarce awareness and indolence of decision makers also hinder a fast development of national eHealth initiatives. Questions of liability and security also cause for delay.

4 SWOT analysis

4.1 Comparison of the systems

Table 3 summarizes the advantages and handicaps of the Australian and German eHealth system in a SWOT analysis. The resulting strategies give suggestions on further developments eHealth can endorse to enhance quality of healthcare in Germany.

Table 3: SWOT analysis of Australian and German eHealth systems

	Germany	Australia
<i>Strengths</i>	<p>S1: Advanced technological foundation and development</p> <p>S2: Legal requirements for eHealth explicitly defined in fifth social security code</p> <p>S3: Regulations for data safety and security</p> <p>S4: High mobile penetration and broadband coverage</p> <p>S5: Governmental support</p> <p>S6: Funding opportunities on international level (EU)</p> <p>S7: Integrated solution of mandatory EHC and optional eHealth applications in one system</p>	<p>S1: General guidelines based on the Commonwealth Privacy Act 1988 and the Australian Privacy Principles (APP)</p> <p>S2: Flexible infrastructural solutions</p> <p>S3: First attempts at national standards</p> <p>S4: Secure messaging system</p> <p>S5: High quality of care</p> <p>S6: Adaptability of eHealth strategy</p> <p>S7: Nationwide platform for interaction and information exchange</p> <p>S8: Lower usage barriers through change to an opt-out model</p>
<i>Weaknesses</i>	<p>W1: Lack of IT standards in healthcare</p> <p>W2: Isolated solutions</p> <p>W3: High bureaucracy through governmental involvement</p> <p>W4: Common infrastructure still not available</p> <p>W5: Lack of experience with patient involvement</p>	<p>W1: No legal binding to use or adapt eHealth</p> <p>W2: Isolated solutions</p> <p>W3: Fragmented system</p> <p>W4: Missing nationwide governmental cooperation</p> <p>W5: Dispersed data storage</p>

<i>Opportunities</i>	<p>The mandatory cross-linkage between healthcare providers can enable an uninterrupted communication network</p> <p>Lower adoption barriers through combination of mandatory and voluntary services</p> <p>Better information exchange</p> <p>Increase in efficiency and transparency of healthcare delivery</p> <p>Citizen's mobility requires increased data sharing</p> <p>Increased computer literacy and ICT skills</p> <p>Re-use of knowledge and applications</p> <p>Reduced unnecessary and duplicate treatments</p> <p>Increased scalability of eHealth solutions</p>	<p>Flexibility in strategical decision enables fast adjustments</p> <p>Lower adoption barriers through change to an opt-out model</p> <p>Better information exchange</p> <p>Increase in efficiency and transparency of healthcare delivery</p> <p>Citizen's mobility requires increased data sharing</p> <p>Increased computer literacy and ICT skills</p> <p>Re-use of knowledge and applications</p> <p>Reduced unnecessary and duplicate treatments</p> <p>Increased scalability of eHealth solutions</p>
<i>Threats</i>	<p>Delayed roll-out of holistic infrastructure</p> <p>Protracted legal changes</p> <p>High bureaucracy implications for nationwide decisions</p> <p>User acceptance of eHealth innovations</p> <p>Lack of skilled professionals</p> <p>Incomplete documentation</p> <p>Data privacy, confidentiality, liability and data protection</p>	<p>Low adoption rates by healthcare professionals</p> <p>Weighing between effort and benefits for individual providers</p> <p>Difficulties integrating fragmented eHealth market</p> <p>User acceptance of eHealth innovations</p> <p>Lack of skilled professionals</p> <p>Incomplete documentation</p> <p>Data privacy, confidentiality, liability and data protection</p>

4.2 Strategies derived from the SWOT analysis

Germany and Australia pursue different approaches with their national eHealth strategy. Whereas Australia initially invested in an open, voluntary platform solution, Germany instructed a long-term statutory basis for an integrated infrastructure for extensive eHealth services based on a mandatory insurance card. Changing the My Health Record platform to an opt-out model can reduce the barriers for user registration, meaningful use of the proposed service, however, will require additional effort by the Australian government. The German example shows that the utilization of national technology resources and know-how can be used to systematically invest and plan for comprehensive eHealth applications. Applications can therefore be developed on a common ground, facilitating the re-use of key insights and results. The downside in the implementation of a nationwide eHealth project is reflected in protracted legal changes and limited reaction to changing requirements. On the other hand, although development of individual applications may increase implementation flexibility and speed and allow for modular adjustments, the subsequent integration of fragmented solutions can result in major adaption requirements, insufficient scalability, and unnecessary duplicates.

Table 4 and Table 5 summarize the derived insights from the SWOT analysis, indicating strategies for Germany and Australia to utilize the countries' capabilities for exploiting the proposed opportunities and handle emerging threats.

Table 4: Opportunities for Australia and Germany

Opportunity	Australia	Germany
O1: Integrated healthcare data + applications	W1/W2/S2: Two-sided approach to integrate currently isolated solutions and adapt infrastructure accordingly	S1/S2: Use the mandatory linkage of all healthcare providers to combine health information from all linked partners as well as patients in an integrated system to gain holistic insights over bigger patient cohorts. W4/S1/S5/S6: Support and contribute to infrastructural development with funding projects
O2: Cross-linking of healthcare providers	W1/S1: Provide more binding regulations to join the nationwide network S4: Create awareness for eHealth advantages in field studies	S2/S5: The cross-linkage of healthcare providers is already determined by law and currently tested in field studies. Collaboration should be further supported and monitored by the government
O3: Increasing User acceptance + IT literacy	S7/S8: Engage consumers in participating in voluntary eHealth services by providing comprehensible personal insights	S4: With high mobile penetration and broadband coverage of German citizens and healthcare providers, mobile applications and IT solutions to link healthcare consumers should be implemented
O4: Better information exchange	S3/S4: Provide easy and secure methods to share and exchange data	S3/S4/S7: Provide easy and secure methods to share and exchange data
O5: Increase efficiency and transparency of healthcare delivery	W4/S5/S6: Continuous monitoring of healthcare expenditure and health quality indicators to monitor performance and impact of eHealth solutions S8: Engage consumers in participating in voluntary eHealth services by providing comprehensible personal insights	S2/S5: Continuous monitoring of healthcare expenditure and health quality indicators to monitor performance and impact of eHealth solutions W5/S7: Engage consumers in participating in voluntary eHealth services by providing comprehensible personal insights
O6: Increased communication and collaboration	S4: Secure messaging system already in place.	S1/W5: Implement secure messaging service to enable communication and coordination between patients and healthcare providers
O7: Re-use of knowledge and applications	S1/S7: Extend national platform for to share experiences in eHealth service development	W1: Develop open IT standards based on insights from pre-existing solutions S1: Initiate national open source platform for eHealth development to share experiences
O8: Reduce unnecessary and duplicate treatments	W2/S2: Two-sided approach to integrate currently isolated solutions and adapt infrastructure accordingly S7: Aggregate collected data on My Health Record platform to provide a structured history for each patient	S7: Create structured overviews / templates for patients including treatments, medications and personal data as a single source of truth W2: Integrate existing isolated solutions into national infrastructure

Table 5: Threats for Australia and Germany

Threat	Australia	Germany
T1: Incomplete documentation	W1/S1: Provide more binding regulations to participate in the nationwide network S3/S4/S7: Provide easy and secure methods to share and exchange data S7: Aggregate collected data on My Health Record platform to provide a structured history for each patient	S3/S4/S7: Provide easy and secure methods to share and exchange data S7: Create structured overviews / templates for patients including treatments, medications and personal data as a single source of truth
T2: Legal changes	W4/S1: Introduce legal regulations for eHealth on a national level	W3/S2: Systematically monitor issues in eHealth development to enable fast reactions for necessary changes
T3: Bureaucracy implications	W4: Increase national governmental cooperation	W3: Encourage close cooperation between government and healthcare providers for shorter discussion paths
T4: User acceptance	S7/S8: Engage consumers in participating in voluntary eHealth services by providing comprehensible personal insights	S4: With high mobile penetration and broadband coverage of German citizens and healthcare providers, mobile applications and IT solutions to link healthcare consumers should be implemented
T5: Data privacy, confidentiality, liability and data protection	W5: Appoint a single institution to store, manage and secure healthcare data in a structured and reliable way	S1/S3/S5: Ensure secure and stable networks and regulate data access according to different stakeholders; Data authority lies with the consumer
T6: Lack of skilled professionals	S5: Offer training and raise transparency for eHealth services	S5: Offer training and raise transparency for eHealth services

5 Discussion and Conclusion

In this paper, we analysed the potentials and challenges of national eHealth strategies in Australia and Germany. Based on macro-environmental factors, i.e. governmental support and policies, technology and infrastructure, and user acceptance and accessibility, key capabilities and handicaps were identified for each country. Based on these results we derived strategies on how to exploit the positive effects and opportunities of eHealth and how to handle challenges that might arise concurrently. Our results suggest similar findings for developed countries, especially with regards to major challenges in healthcare that are planned to be addressed by eHealth solutions. Both countries attempt to increase efficiency and transparency in healthcare, increase communication and collaboration between healthcare participants, and provide overall better quality of care. The meaningful use of health information, development of national standards and regulations, and application integration are also focused in the individual eHealth strategies. Two approaches to reach these goals have been identified: The German strategy combines partly statutory and voluntary information sharing within an integrated system, whereas the Australian platform-based solution relies on an entirely optional system. Both countries can profit from different insights already gathered from other national eHealth approaches. With Germany as a leading player in technology advancements and an already well-established legal foundation for eHealth regulations on the one hand and Australia's flexible

adaptions and early experiences within eHealth in contrast, both countries can provide different knowledge aspects for successful eHealth implementation and a high level of quality of care to other countries.

The implications of this paper are threefold. From a research perspective, the proposed approach to analyse eHealth strategies based on macro-environmental factors, i.e. governmental support and policies, technology and infrastructure, and user acceptance and accessibility, can be adapted to other countries to provide a common ground for an in-depth, global analysis of national eHealth strategies. From a practical viewpoint, the recommendations resulting from the SWOT analysis can be further extended and adjusted to future developments and therefore allow for continuous improvement of both countries' eHealth initiatives. To that end, the comparative analysis can also ease the initiation of national strategies by identifying best practises and lessons learned from early eHealth adopters.

It has to be noted, that these results are based on the current legal and technological advances in eHealth in Germany and Australia. At the moment, however, major changes are taking place in both countries. In Germany, a new eHealth law has laid down an obligation to link healthcare providers in the national telematics infrastructure currently under development. First results and the impact of this regulation will be seen in the following years. The change of an opt-in to an opt-out model for the Australian eHealth platform My Health Record will also entail major alterations in the country's eHealth strategy and development that should be addressed in future studies. Furthermore, the implications of this study should be enriched, by analysing other national eHealth strategies in developed countries, to provide insights from a more global perspective. Through the ongoing digitization of healthcare services, eHealth strategies and solutions are of increasing importance and demand for an international exchange of best practises, the development of technology standards and sufficient infrastructure as well as governmental support on a global scale.

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