PROSPECTS

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Review

EXPLORING DIGITAL HEALTH HORIZONS: A NARRATIVE REVIEW OF E-HEALTH INNOVATIONS IN POLAND, SPAIN, ROMANIA AND ESTONIA

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ABSTRACT

E-health offers new opportunities for self-management, health and social care and access to health information. Over the last decade, the use of e-health solutions by patients, healthcare providers, professionals and citizens has increased significantly. This article provides an overview of e-health innovations in Poland, Spain, Romania and Estonia, focussing on the digital development of healthcare services. It outlines the concept of e-health and the innovative solutions the countries listed have introduced in this area. They all face challenges such as the cost of implementing new technologies, data access and the security of patient data. As a result, there is a constant need for coordinated collaboration, legislation and clear guidelines for the use of technology in healthcare. The lessons learnt from these countries are helping to shape the digital future of healthcare in Europe. In Poland, the Ministry of Health oversees the e-Health Centre, which has made remarkable progress in the field of e-health services such as the Internet patient account, electronic prescriptions and electronic referrals. The biggest challenges include financing innovation and improving digital skills. Poland has also recently introduced the no-fault system as an alternative compensation system for medical errors, modelled on similar systems in Denmark and Sweden. Technological progress is driving the transformation of the Spanish healthcare system, which is particularly evident in the area of telemedicine and innovative healthcare systems. The Spanish Digital Health Strategy lines up with broader national initiatives. Despite challenges such as underfunding, Romania has introduced digital healthcare with the Electronic Health Record since 2014. As an absolute pioneer in the digitalisation of healthcare in Europe, Estonia is proud of its achievements in the digitalisation of healthcare data and services. The Estonian e-Health Foundation and the nationwide health information system are an example of seamless integration and set a benchmark for comprehensive digital healthcare.

KEYWORDS: e-health, innovation, healthcare, health system

1. Introduction

E-health is a set of technologies used with the help of the Internet to provide health services that improve quality of life and promote health care [1]. E-health includes categories such as e- prescriptions, electronic sick notes, electronic referrals, electronic medical records (EDM), mobile devices for health protection and health monitoring, Internet patient accounts, remote medical care and electronic consultations, health mobile applications and health IT systems [2]. The development of the infrastructure for digital e-health services is one of the priorities of the European Union (EU), and the degree of its implementation in national healthcare systems varies across EU Member States. Estonia, Denmark, Finland, Spain and Sweden have a high rate of e-health

implementation. In contrast, the use of e-health is lowest in Central and Eastern Europe [3,4]. As the COVID-19 pandemic has affected many facets of healthcare systems, careful planning is required to ensure the sustainability of the system, the availability of staff and the care structure. Digital health technologies, including teleconsultations in primary healthcare, have become more widespread in Poland due to the lockdown imposed by the ongoing COVID-19 pandemic [5,6]. A quarter of Polish healthcare executives state that one of the key priorities for the future is to catch up with the leading healthcare providers. Investments in digital medical records and telemedicine meet current market needs and prepare the healthcare sector for future innovations and the introduction of more advanced technologies, including artificial intelligence (AI), which will help to ensure more advanced forms of care [7]. Digital health interventions are often the subject of health economic evaluations. Arak and Wojcik concluded that there is a 2:1 return on e-health investment, and the average breakeven point for the ten e-health initiatives studied was five years. The authors also stated that, on average, digital solutions could reduce the health expenditures of most European countries by 0.31% of GDP or 5% less spent on health by the taxpayer [8]. In a review by Gentili et al., the evidence was found that digital health interventions can also affect cost-effectiveness and favorably affect costs and health outcomes. In particular, the findings positively impacted studies that implemented a new mobile application or a web portal intervention [9]. However, due to heterogeneity in research methods, different cost perspectives, and uncertain data, there are no exact numbers on how the introduction of e-health services may impact cost-effectiveness [8,10]. Amid the global COVID-19 pandemic, Poland, Spain, Romania and Estonia showcase distinctive approaches to e-health, each grappling with challenges and making significant strides in healthcare innovation.

2. Poland

Since 2003, Polish health care have been financed, monitored and managed by the Ministry of Health, the National Health Fund (NHF) and local authorities. The Ministry of Health plays an important role in defining national health policy, financing and implementing health programmes, financing some highly specialised services, scientific research and training health personnel. It also performs a number of supervisory and administrative functions for some health system institutions, including the state-run NHF [11]. In the last five years, Poland has made significant progress in the development of public e-health services. In Poland, the Ministry of Health oversees the e-Health Center, a specialized budgetary unit in charge of developing and implementing public e-health service [12]. At the national level, services such as the Internet Patient Account (IKP), First Contact Teleplatform, Electronic prescription (e-prescription), Electronic referral (e-referral), Electronic sick leave (e-release), Electronic registration for COVID-19 vaccinations, Electronic Verification of Beneficiaries' Entitlements (e-WUŚ), Information about treatment dates (e-queue) and Electronic exchange of medical records have been introduced [13,14]. The IKP collects data from the Medical Information System, the Integrated Patient Information System, the Social Insurance Institution and the Registry of Entry to Poland.

Patients can find information about e-prescriptions issued and filled, past visits to health care units, medical services provided, referrals issued, e-sick notes issued, medical certificates, and medicines and medical devices reimbursed by the National Health Fund. The IKP also allows to select and change a primary care doctor/nurse/midwife, grant access to medical records, submit an application for a European Health Insurance Card, consent to health services and provide the medical unit with your e-prescription or e-referral [15]. It is estimated that by December 2023, over 17.8 million patients had opened an IKP account. Services such as e-prescription and e-referral are directly related to IKP, with 1.8 billion and 169 million issued so far, respectively [14]. However, challenges persist in the form of financing innovation costs, enhancing digital competencies among medical staff, and addressing the limited knowledge and acceptance of e-health, especially among the elderly [16]. To address these challenges and propel Poland into a technologically advanced healthcare future, the "Program for the Development of E-Health in Poland for 2022-2027" has been outlined [17]. This comprehensive roadmap delineates strategic goals and initiatives aimed at further enriching and expanding the e-health ecosystem. Emphasizing Poland's steadfast commitment to forefront technological advancements, the program seeks to enhance patient outcomes, improve efficiency, and foster a more patient-centric healthcare system.

2.1 No-fault system in Poland

In 2023, the Act amending the Act on the Patient Ombudsman entered into force [18]. It introduced a no-fault system for compensating for medical incidents in hospitals modelled on similar systems in Denmark and Sweden, among others. The "No-fault system" aims to enable patients to obtain compensation more quickly than compensation and damages in court proceedings and more quickly than in the proceedings before the provincial medical incident commissions in force from 2012 until 2023 [19]. The No-fault system is expected to lead to a reduction in the number of court proceedings. The introduction of the No-fault system is caused by the increasing number of claims by patients in connection with, or as a result of, the provision or omission of healthcare services. In the next decade, failure to provide healthcare services will occur in Poland, particularly in oncology. The increasing number of patients with suspected cancer will result in errors in diagnosis, understood both as failure to diagnose ("in time") and misdiagnosis ("mistakes in diagnosis"). The problem of a lack of 'timely' diagnosis was supposed to be solved by the National Programme for the Control of Cancer, enacted in 2005 [20], and the introduction of the Diagnostic and Oncological Treatment Card ('DiLO') in 2015 [21]. However, the increase in the number of patients decreases the timeliness of diagnosis each year; the number of patients with suspected disease is inversely proportional to timeliness. Moreover, in 2017, in fourteen provinces, the number of cancers diagnosed without a DiLO card exceeded those diagnosed with a DiLO card [22]. The problem of misdiagnosis is due, among other things, to an insufficient number of oncologists. In one of the judgments in a case of delayed diagnosis of cancer, handed down after eight years of proceedings, the Supreme Court stated that in the case,

"it was not possible to determine on whom the duty of care for the patient rested, whether this duty bound both of the accused doctors or one of them, and perhaps still other persons working in the same ward" [23]. Consequently, diagnostic errors prevent patients from detecting disease early, which is crucial to their survival rate, and from the legal side, constitutes damages and may lead to an increase in patients' financial claims. One of the decisive factors in an injured patient's decision to file a lawsuit was how the hospital or doctor had already behaved after the event that resulted in the patient's injury [24]. Therefore, responding to the requirement introduced by the Law of June 16, 2023 [25] on Quality in Healthcare and Patient Safety and in force since September 7, 2023 to maintain quality control systems for the provision of healthcare services in medical entities, it seems crucial to examine the impact of the organization of treatment and the impact of communication with patients on the filing of lawsuits by patients.

3. Spain

Spain is the third largest country in western Europe and it has been a member of the EU since 1986. In the statutory Spanish National Health System (SNS), coverage is virtually universal, mainly funded from taxes, and care is predominantly provided within the public sector [26]. The healthcare landscape in Spain is undergoing a remarkable transformation, driven by a surge in technological advancements reshaping patient care and system efficiency [27]. Telemedicine has emerged as a frontrunner, enabling remote consultations and reducing unnecessary in-person visits, a trend that gained significant traction during the COVID-19 pandemic [28,29]. Intelligent healthcare systems represent another frontier in Spain's healthcare transformation. These systems leverage data from patient health monitoring devices, such as pulse oximeters, blood pressure monitors, and glucometers, to provide real-time insights into patient health. This data-driven approach enables healthcare providers to proactively monitor patients' health status, identify potential risks, and intervene early to prevent complications. In 2021, Spain implemented a system for intelligent monitoring of patients with chronic diseases, utilizing data from monitoring devices provided by healthcare facilities. This system empowers doctors to remotely analyze patient data, providing timely advice, referrals, and interventions to maintain patients' health and well-being [27,30]. E-health initiatives are crucial in streamlining healthcare delivery and enhancing patient engagement in Spain. These e-health solutions empower patients to actively manage their health, fostering greater transparency, accessibility, and convenience [31]. Moreover, e-health platforms facilitate communication between patients and healthcare providers, enabling timely interventions and improved patient outcomes [32]. Recognizing the immense potential of these technologies, the Spanish government has spearheaded the development of a comprehensive Digital Health Strategy [33]. The Digital Health Strategy alignment ensures that digital transformation efforts are woven into the fabric of existing healthcare policies, fostering a cohesive and comprehensive approach to healthcare delivery. This strategic roadmap is anchored in user-centricity, accessibility, data privacy, cloud-based operations, and

value maximization. The strategy seeks to improve health outcomes by leveraging data analytics and evidence-based decision-making [34]. Furthermore, the strategy capitalizes on synergies with European programs like Digital Europe, Europe-4-Health, and Horizon Europe, enabling knowledge exchange and collaboration on a global scale. Spain's Digital Health Strategy aligns harmoniously with broader national initiatives, such as Digital Spain 2025, the National Artificial Intelligence Strategy, and the Personalized Medicine Strategy. The Digital Spain 2025 Strategy outlines a comprehensive plan to enhance digital connectivity, skills, and innovation across Spain. It sets ambitious targets to ensure that by 2025, 100% of the population has access to high-speed internet, 80% of individuals possess basic digital skills, and 20,000 cybersecurity, AI, and data specialists are trained. Additionally, the strategy aims to make 50% of public services accessible through mobile apps and encourage 25% of companies to adopt AI and big data technologies. By achieving these goals, Spain aims to become a leader in the digital transformation era [35]. This synergy ensures that digital transformation efforts in healthcare are seamlessly integrated with broader national agendas, fostering a holistic approach to technological advancement.

4. Romania

Romania is an upper-middle-income country with an economy that is the 13th largest in the European Union. Since January 1, 2007, Romania has been a member of the European Union [36]. Significant obstacles have plagued Romanian healthcare, including underfunding, a lack of medical personnel, and corruption. Less than 5% of GDP is spent on public healthcare, which is still among the lowest in Europe [37]. In FutureProofing Healthcare's European Personalized Healthcare Index report, Romania is ranked 31st out of 33 countries assessed [38]. Despite all of the difficulties, Romanian healthcare is evolving digitally. The Electronic Health Record (EHR) (Dosarul Electronic de Sanatate) was implemented in 2014. It was initiated by the National Health Insurance House (Casa Nationala de Asigurari de Sanatate, CNAS). CNAS manages the Health Insurance Information. The platform consists of an integrated health information system, the national system of the social health insurance card, the national system of electronic prescriptions, and the system of patients' electronic health records [37]. Since its founding in 2014 and through the end of 2021, 16 million EHRs have been created [39]. Currently, Romania does not use all EHR functionality. However, expectations in this respect are positive, as one of the goals of the new strategy is to expand the use of EHRs to include information from population screening programs and laboratory, outpatient, rehabilitation, oral hygiene, and home care services [39].

5. Estonia

Estonia is in the north of Europe, with 1.3 million citizens, approximately 4,500 physicians, and healthcare costs making up about 7.5% of the annual GDP in 2021 [40]. Estonia can now be considered Europe's digital leader.

It started with the first step in digitization in 1995, when all Estonian schools were connected to the internet. Noteworthy is the health system's revolution with the help of digital solutions: e-Health Records, e-Ambulance, and e-Prescription. Currently, 99% of the health data are digitized, 99% of prescriptions are digital, about 2.3 million monthly queries related to medical information are identified, and the billing of healthcare services is 100% electronic [41]. The Estonian e-Health Foundation is the central agent in charge of standardization and the development of digital medical documents. Relevant legal foundations of the system were set in 2007 with the regulations. The Estonian Patient Portal (PP) enables people to view and modify personal information gathered from different public databases. The PP includes information about one's general practitioner, health insurance, prescribed and bought medicine and outpatients care summaries. The PP also enables to communicate permissions and requests to the government and health care providers, for example to allow to accept blood transfusions or becoming an organ donor [42]. The Estonian digital health platform (DHP), called the Estonian nation-wide health information system (EHIS), allows secure and trusted online access to medical data, different kinds of medical documents, prescriptions, and medical images of virtually every Estonian resident. Completely linked with the e-government systems of Estonia, it offers each person a digital identity along with safe authentication techniques, once-only data linking, and other advanced e-services [40]. In 2015, Estonian ambulances went digital, and in 2016 they introduced a decision support system to notify doctors about drug interactions. Electronic ambulances enable quick transfer of information about the patient's condition between the incident scene and the hospital. This shortens response time, which is crucial in emergencies [43]. Estonia saves about 2% of its GDP in salaries yearly from its open and interoperable e-State services [44].

6. Conclusions

While each country charts its course, common challenges unite them. Technology implementation costs, access to high-quality medical data, and ensuring the security of patient information remain universal hurdles. The potential of medical technology, magnified by the COVID-19 pandemic, necessitates coordinated efforts at the national level, emphasizing the need for appropriate legislation and clearly defined guidelines. In Poland, initiating key services such as the Internet Patient Account (IKP), e-prescription, e-referral, and others demonstrates Poland's commitment to enhancing patient accessibility, streamlining healthcare processes, and fostering a more efficient care delivery model. Spain has embraced technological advancements in healthcare, mainly through the widespread adoption of telemedicine and intelligent healthcare systems. Despite facing significant challenges such as underfunding and a shortage of medical personnel, Romania has made strides in digital healthcare. The implementation of the Electronic Health Record in 2014 and subsequent efforts to expand its functionality reflect a positive trajectory. Estonia is a digital leader in Europe, with an impressive track record in digitizing health data and services. Estonia's seamless integration of e-health into its broader e-government systems sets a precedent for other nations aspiring to achieve comprehensive digital healthcare systems.

Poland has also recently introduced the no-fault system as an alternative system of compensation for medical errors, modeled on similar systems operating in Denmark and Sweden. However, as the number of patients increases, especially in oncology, there is concern that the system may not prove effective in providing compensation to patients and reducing lawsuits. It is, therefore, important to study how the organization of treatment and communication with patients affects the filing of lawsuits by patients.

Digital health technology has the potential to facilitate and improve medical education, conducting clinical trials, self-management of chronic disease with wearable technology and smartphone apps, and clinical decision-making, which can be supported by support systems and enriched with advanced analytics. Despite many limitations, AI-based systems offer a unique opportunity to increase physician productivity by creating order and transforming vast amounts of primarily unstructured data [45,46]. In today's healthcare, e-health will become a critical infrastructure element, and healthcare organizations must develop policies to apply e-health data security. A possible research direction in this topic could be related to studying the privacy and security regulations in the healthcare sector. Hospitals can implement a biometric system that helps keep patient data safe by allowing easy and secure access to patient information [47,48].

In the sight of European E-health, this tapestry of innovations and challenges underscores the imperative for continual adaptation, collaboration, and a shared commitment to leveraging technology for the betterment of healthcare and, ultimately, the well-being of citizens. As these nations forge ahead, the lessons learned from their experiences contribute to the collective knowledge shaping the future of healthcare on the digital frontier.

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