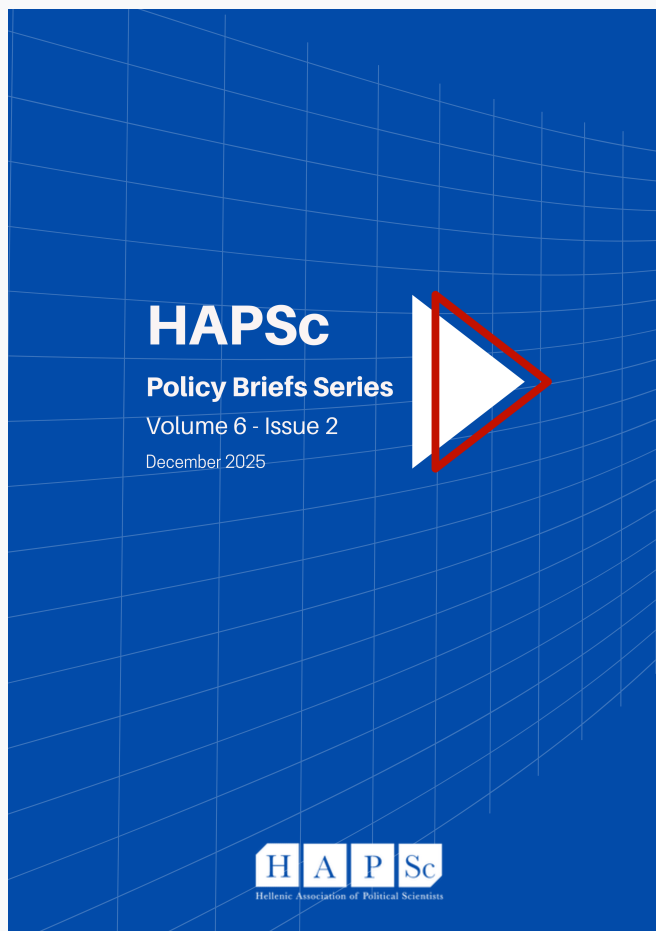


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### Electronic Health: Challenges, Prospects and Applications in Cyprus, Greece and EU

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# Electronic Health: Challenges, Prospects and Applications in Cyprus, Greece and EU<sup>1</sup>

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## Abstract

Electronic health (e-Health) is a crucial sector of modern healthcare and greatly enhances the quality of healthcare services. The application of e-Health in Cyprus, Greece and the EU faces many challenges, such as the lack of infrastructure, legal issues and the need of training healthcare providers. However, it offers many significant prospects, such as improving quality by strengthening infrastructure and digitizing services aiming to achieve better data management and increased personal data security. E-health is implemented in Cyprus through the General Healthcare System (GHS), in Greece through the National Health System (ESY) and in the EU through many strategies and initiatives. The collaboration of the Member States is crucial for the achievement of common goals and improvement of the interoperability of healthcare systems. In conclusion, e-Health is the future of healthcare and technological development significantly contributes to the improvement of healthcare services.

**Keywords:** e-Health; Telemedicine; Electronic Healthcare Record; Interoperability; Data Security; Legal Frameworks; Information and Communications Technology (ICT)

## Introduction

Living in this era of digital transformation, healthcare could not remain unaffected. However, how can the healthcare system respond to the growing need for remote healthcare services? How can medical data be managed remotely and treatment be provided without the presence of the doctor? The COVID-19 pandemic has totally changed the way of thinking about healthcare, as the demand for telemedicine services increased rapidly within a short period. The development of technology, promoting electronic health (e-Health), may be able to answer these questions (Baudier et al., 2023).

E-health is a field of medical informatics and refers to all health systems that are transmitted through the electronic platforms (da Fonseca et al., 2021). The World Health Organization (WHO) defines e-Health as the cost-effective and secure use of information and communication technologies (ICT) for supporting the healthcare sector (World Health Assembly, 2005). According to the e-Health Action Plan (2012-2022), ICT applications in healthcare have an impact on efficiency, improvement of health services' quality and to the

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contribution of the economic and social value of health (European Commission, 2012). E-health significantly enhances the cost-effectiveness ratio in healthcare, with the result of making processes more efficient (Eysenbach, 2001). Additionally, it includes many tools and utilities for health services management, patient care and monitoring (Scholz, 2015).

The digital health should benefit patients in an ethical, secure and fair manner. It should support equitable access to quality healthcare services, disease prevention and diagnostic management (World Health Organization, 2021). Finally, there are many challenges regarding research approaches to the methodology, implementation and evaluation of healthcare systems (Ahern, 2007). The purpose of this study is to examine the challenges that e-Health sector is facing, the prospects of development and the applications of electronic health in Cyprus, Greece and the European Union (EU).

## **E-Health Challenges**

In Europe and especially in Cyprus and Greece, eHealth is an important tool for the development of healthcare system. However, although e-Health has made significant progress and offers various benefits, there are still considerable challenges that remain.

### ***Challenges in Cyprus***

Since 2019, Cyprus has adopted EHRs through the General Healthcare System (GHS) in accordance with legislation set by the Ministry of Health. This law includes specific guidelines regarding the content and use of EHRs, but the integration of interoperable systems is insufficient and telemedicine services have not been sufficiently developed. As a result, it becomes challenging to fully leverage the benefits of EHRs and limits the ability of healthcare providers to collaborate effectively. Another significant challenge that the healthcare system of Cyprus is facing is raising awareness among healthcare professionals about standardization in the implementation of EHRs and data security issues. It is crucial to establish training and educational programs to enable healthcare professionals to take full advantage of the opportunities offered by EHRs (Papaioannou et al., 2021).

The healthcare system of Cyprus is divided into two sectors: the public and private sector. However, it faces many challenges related to operations and the lack of coordination between these two, resulting in the absence of an integrated healthcare system that limits patient access (Sementilli et.al., 2007). Additional challenges arise from legal and infrastructural issues, such as the need to harmonize legislation with EU directives and improve the quality and reliability of infrastructures. Cyprus faces deficiencies in essential infrastructure related to data security and monitoring, which affects the trust of patients and healthcare professionals in the system (Angelidis et al., 2010). The challenges faced by the healthcare system in Cyprus require the collaboration between the two sectors and increased funding for infrastructure. By addressing these issues, e-Health can offer significant benefits to the Cypriot healthcare system.

## ***Challenges in Greece***

The National Healthcare System in Greece, known as National Health System (ESY), was established in 1983 with the purpose of improving the organization and the accessibility of healthcare for all citizens of the country, including both public and private sector (Kondilis et al., 2012). However, despite the useful features that help in the efficiency of healthcare services, e-Health and the use of EHRs face various challenges.

Healthcare professionals consider the healthcare system as complex and express concerns about the lack of financial resources and the effective use of EHRs, resulting in negative impact on the quality of patient care. Furthermore, one of the most significant challenges facing Greece's healthcare system is the lack of interoperability between different healthcare organizations (Katehakis, 2018). The absence of a legal framework that facilitates collaboration between different organizations makes it difficult to implement e-Health services effectively. There is a need for a regulatory framework that facilitates collaboration and ensures the protection of personal data (Fragidis and Chatzoglou, 2012; Katehakis et al., 2018). Another challenge in Greece's healthcare system is the training of healthcare professionals, as many healthcare workers lack sufficient knowledge about the use of EHRs, which limits the effectiveness and quality of care. To address the above challenges, there is a need to develop standardized protocols to facilitate data exchange, improve infrastructure and create various training programs to enhance the knowledge of healthcare professionals regarding EHRs (Katehakis, 2018).

## ***Challenges in the EU***

In the European Union (EU), e-Health is a crucial sector for development, but its implementation comes with significant challenges limiting its effectiveness. Specifically, the EU consists of Member States that have different healthcare systems, legislation and technological infrastructures. Each EU country has its own approach to using healthcare systems, influenced by funding and administrative structures. Therefore, there is no unified operation model, making it difficult to implement solutions in healthcare systems and adapt common standards. Additionally, there are also legal issues since the same laws and regulations do not apply in the different countries of Europe (Fragidis and Chatzoglou, 2018). Moreover, in some less developed EU countries, there is insufficient access to infrastructure and internet. This results in limited e-Health implementation strategies and restricted access to digital healthcare compared to more developed countries.

Other e-Health challenges in the EU include insufficient training for healthcare professionals. This is a critical issue, as professionals are responsible for managing healthcare systems and need to be familiar with digital services (Quaglio et al., 2016). Additionally, the complexity of healthcare systems, data security concerns and the high cost of installing information systems to support eHealth remain major challenges (Odone et al., 2019). It is also worth noting that a major impact in the e-Health sector is the Internet of Things (IoT), which connects medical devices and sensors to the internet for patient health monitoring. However, there are some challenges regarding patient data security, as there is a risk of data breaches and cyber threats (Kovačić et al., 2022).

Finally, the most significant challenge across the continent is interoperability. In simple terms, different healthcare systems cannot communicate effectively, making it difficult to transfer and analyze data between Member States (Cowie et al., 2017; Quaglio et al., 2016). For example, in Denmark, healthcare professionals often lack access to essential patient information needed for decision-making. A specific example is electronic prescribing in Denmark, where the lack of interoperability in healthcare systems makes it difficult to access patient records (Kierkegaard, 2013).

## **E-Health Prospects**

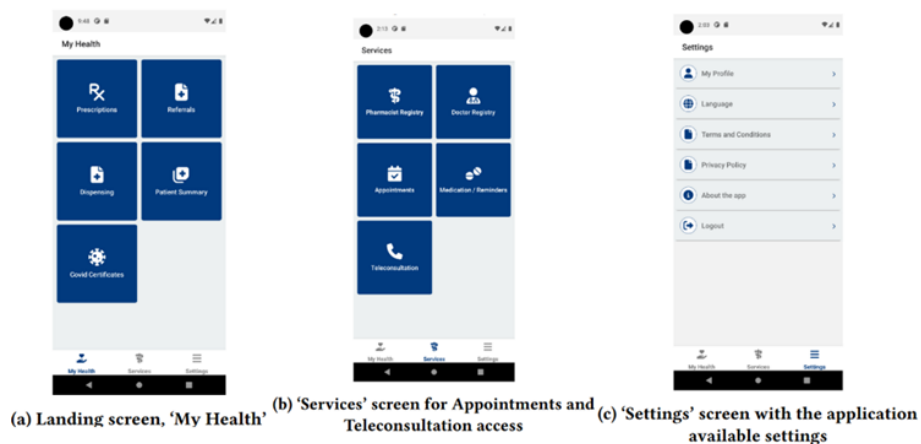
E-Health faces several challenges in Cyprus, Greece and at the European level, as mentioned above. However, it also offers numerous prospects and opportunities for improving healthcare through continuous investments in digital technologies.

### ***Prospects in Cyprus***

E-Health in Cyprus has developed significantly following the implementation of GHS, offering numerous prospects. The creation and implementation of a comprehensive Electronic Health Record (EHR) system, such as e-Health4U, is a key objective. This system aims to provide a digital health infrastructure that integrates innovative technologies, meets the needs of citizens and ensures the protection of personal data. The e-Health4U project aims to implement e-Health services at the European level, in alignment with the e-Health Digital Service Infrastructure (eHDSI) initiative and European Directive 2011/24/EU, which guarantees patients' rights to cross-border healthcare. The prospects of this project include Patient Summary as well as the e-Prescription, which through the HL7 FHIR standards, will allow patients to access their health data across borders, improving healthcare accessibility and service delivery (Papaioannou et al., 2021).

Following the COVID-19 pandemic, telemedicine services have expanded, offering remote healthcare services. With the extension of the e-Health4U project in Cyprus, a mobile application called MYe-HealthAppCY was developed, aimed at providing teleconsultation medical services (Figure 1). Unfortunately, Cyprus lacks a wide range of telemedicine solutions and this application could serve as a foundation for integrating more healthcare services in the future. Through interoperability and the use of standardized frameworks, the application represents a significant advancement for Cyprus's healthcare system. The prospects of this application include its integration with existing healthcare systems and ensuring the protection of health data (Canciu et al., 2023). However, to achieve these goals, it is essential to educate the citizens of Cyprus and provide comprehensive information on the use of digital technologies.

**Figure 1. The MYe-HealthAppCY application with its functionalities**



Source: Canciu et al. (2023).

### ***Prospects in Greece***

Like Cyprus, Greece is also at an advanced stage of e-Health development, offering numerous prospects. These include the improvement of IT infrastructure and systems, the monitoring of health indicators and the support of disease prevention and health promotion. Additionally, the creation of secure data networks for information exchange between healthcare providers represents a crucial advancement in Greece as well (Doupi, 2007).

E-Prescription in Greece has also reached a level where it is considered one of the most important developments in e-Health. A study on e-Prescription in Greece highlights the PrescIT Project as a platform that could be used in the future to incorporate all the necessary improvements to the current system. These improvements include the development of a more secure interoperable tool and the simplification of the e-prescribing process (Grammatikopoulou et al., 2024). Moreover, while EHR infrastructure exists in Greece, its full integration has not yet been achieved to ensure comprehensive healthcare provision. The prospects for EHRs include enhancing interoperability, with a focus on functionality and quality standardization in alignment with global standards (Katehakis, 2018).

In addition, as in Cyprus, telemedicine is one of the most significant future advancements. For new health technologies to contribute effectively to improving patient care, it is essential to strengthen the skills of those responsible for the implementation and use of electronic health systems, including telemedicine services. Furthermore, decision-makers must recognize the benefits of e-Health, which includes promoting a sense of equality among citizens. Finally, in the future, e-Health is expected to reduce healthcare service costs through new health technologies (Voutsidou et al., 2019).

### ***Prospects in the EU***

The use of digital technology creates new and innovative possibilities for the future of healthcare in the EU. Healthcare is becoming more patient-centred, with new e-Health technological solutions constantly emerging. The full adoption of e-Prescription, EHRs, and cross-border healthcare are key prospects for the EU. To enable

effective health data exchange, the availability of interoperable digital technologies is essential. Moreover, prospects include the interoperability of national healthcare systems, allowing patients to access their medical history and cross-border care across all EU countries.

The use of robotics and artificial intelligence (AI) could also significantly contribute to healthcare in the future. Although the idea of fully autonomous robots treating patients remains a science fiction scenario, the use of robotic components to support healthcare professionals and patients is already an expanding field.

## **E-Health Applications**

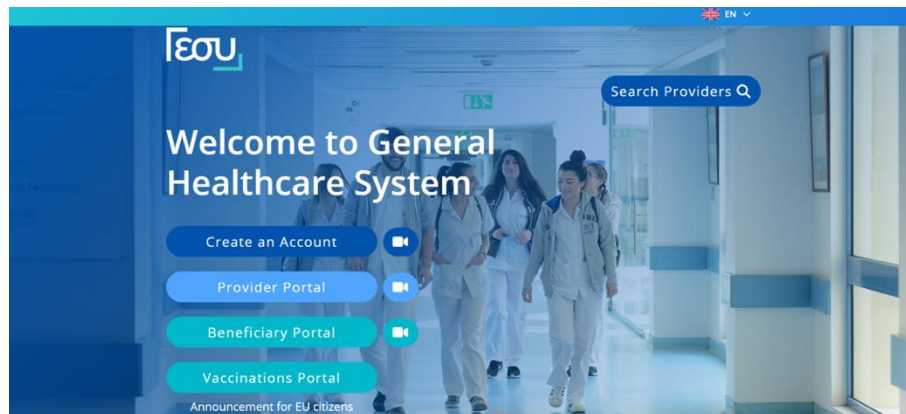
E-Health applications are essential in Cyprus, Greece and the EU, as they contribute to improving access to healthcare, facilitating communication between healthcare professionals and patients, enabling remote health monitoring and ensuring the efficient and secure management of health data.

### ***Applications in Cyprus***

In Cyprus, e-Health applications aimed at improving access to healthcare services and facilitating health data management have developed significantly following the implementation of GHS. GHS was introduced in 2019 to establish a modern healthcare system that provides healthcare services to eligible beneficiaries. Beneficiaries of GHS include Cypriot citizens, permanent residents of Cyprus from the EU and third countries, while healthcare providers consist of medical professionals and institutions from both the private and public sectors. GHS is funded from the contributions of employers, employees, pensioners and the state and is managed by the Health Insurance Organization (HIO) which is responsible for the management and implementation of the system. Through the GHS, various healthcare services are provided, such as primary and secondary healthcare, laboratory tests, medicines, ambulance transport and many more.

One of the most significant benefits of GHS is the electronic management of the patient records and monitoring through its digital platform (Figure 2). Every citizen registered in GHS has an EHR, which can be accessed by healthcare professionals. Specifically, healthcare professionals can use the system to access the medical histories of patients, they can enter electronic prescriptions and facilitate patient care through the platform. GHS is an interoperable healthcare system allowing different healthcare providers from various institutions to access the EHRs of patients. It enables immediate access to healthcare services, organized patient monitoring and efficient care through an integrated IT system. Another important e-Health application in Cyprus is e-Prescription through GHS, which allows the digital recording and management of patient prescriptions. E-Prescription significantly improves prescription security and efficiency, reduces errors, simplifies patient monitoring and allows patients to access their medication history (Health Insurance Organization, 2018).

**Figure 2: The GHS electronic platform providing interoperable management of EHRs, e-Prescriptions and patient healthcare monitoring in Cyprus**



Source: Health Insurance Organization, (2018).

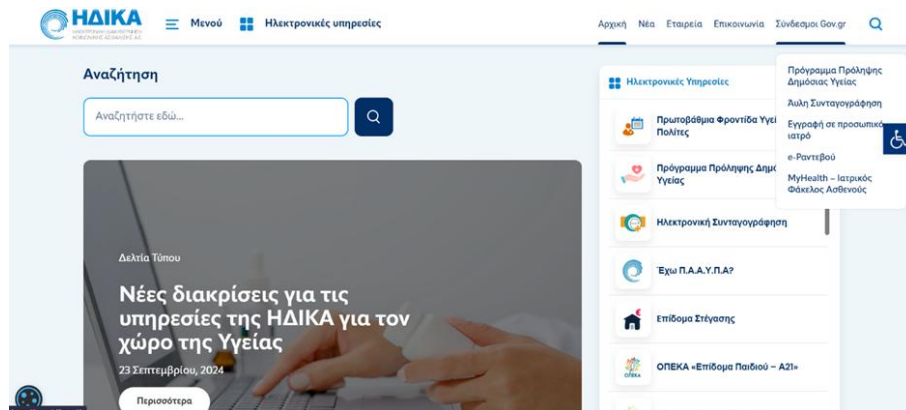
### *Applications in Greece*

In Greece, various e-Health solutions are implemented, with e-Prescription and access to health data playing a significant role. ESY was introduced in 1983 in Greece and is funded by the National Organization for the Provision of Health Services and the state. The Greek healthcare system provides primary and secondary healthcare services (OECD & European Observatory on Health Systems and Policies, 2023). The IDIKA S.A. (n.d.) platform was created to enhance the digitalization of social security and healthcare services (Figure 3). Its purposes include the operation, organization and facilitation of citizen access to healthcare services through digital systems. Specifically, through this platform, e-Prescription, referrals for medical examinations, electronic management of appointments with healthcare professionals, the electronic patient records and the paperless prescription are provided. The paperless prescription allows citizens of Greece to receive their prescriptions and referrals electronically, since they are sent via message to the mobile phone or email and are immediately available at pharmacies.

An electronic health record is also provided, where all medical data of patients are recorded, including medical visits, diagnoses and prescriptions. Additionally, through the MyHealth application, citizens can access all their health data and receive notifications for new prescriptions and medical referrals. Overall, IDIKA is an integrated information system consisting of various applications that ensure interoperability through the fast and secure flow of information between different healthcare systems and thus ensuring the efficiency and the provision of high-quality healthcare in Greece (IDIKA S.A., n.d.).

Greece has also made significant investments in telemedicine systems and since 2016 Greece has implemented a telemedicine program called the National Telemedicine Network. It is a telemedicine system that allows patients to access healthcare services remotely, especially on islands and in remote areas. This facilitates patients who cannot travel easily, such as the elderly and provides medical support in regions facing a shortage of doctors (Voutsidou et al., 2019).

**Figure 3: The IDIKA electronic platform offering services such as e-Prescription, patient monitoring and appointment management with doctors.**



Source: IDIKA S.A. (n.d.).

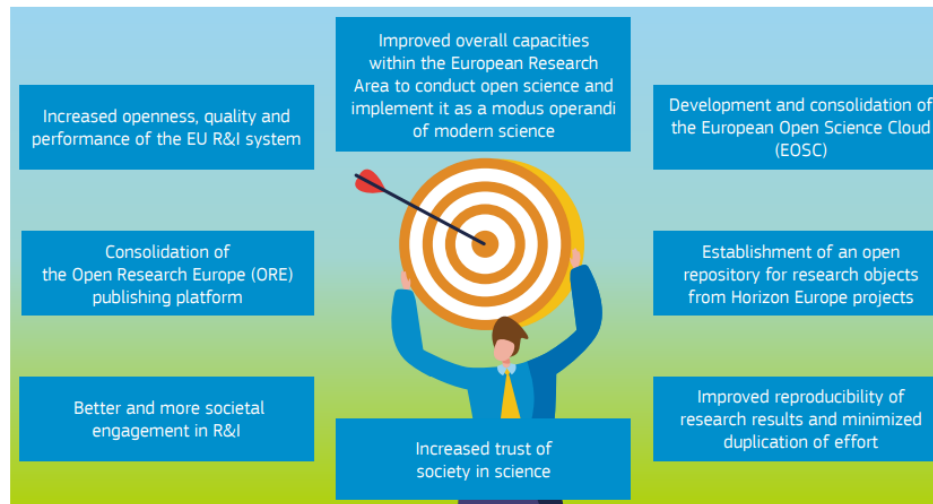
### *Applications in the EU*

The EU is significantly promoting the adoption of e-Health applications across all Member States through programs to enhance interoperability and digital accessibility of healthcare. The EU integrates various strategies to promote e-Health within its Member States and some strategies are illustrated in Figure 4.

The e-Health Action Plan 2012-2020 was an EU strategy aimed at strengthening e-Health to ensure the improvement of healthcare through technology. This strategy included various actions, such as the use of EHRs across the EU for managing health data between patients and healthcare providers. In addition, it included e-Prescriptions, the strengthening of telemedicine for the provision of medical services remotely, cross border care, health data security and the training of healthcare professionals (European Commission, 2012). This strategy laid the foundation for subsequent EU initiatives, such as EU4Health, which was launched in 2021. Also, following the COVID-19 pandemic, the EU4Health 2021-2027 initiative was implemented with the purpose of improving healthcare services, strengthening healthcare systems and preparing for future pandemics by supporting the development of secure and interoperable electronic healthcare systems across the EU (European Commission, 2021a).

The European Commission has also approved a recommendation for the development of a common standard for the exchange of Electronic Health Records. This facilitates health data exchange between EU Member States and promotes access to healthcare for patients travelling to other countries. This recommendation improves the interoperability of healthcare systems and ensures the secure exchange of health data. The GDPR is also being implemented giving citizens the right to access their personal health data and establishing a legal framework for their protection (European Commission, 2021c; European Commission, 2025b).

**Figure 4: EU strategies for research, innovation and the promotion of e-Health, aimed at increasing interoperability, improving digital health services and strengthening trust in science**



Source: European Commission, Directorate-General for Research and Innovation (2021).

Additionally, through myHealth@EU, electronic prescriptions and cross-border access to digital health data within EU Member States are made possible. This platform is expected to enhance cross-border healthcare, especially in cases where citizens need treatment while they are in another country (European Commission, 2025a). In summary, e-Health in Europe is continuously evolving, adopting new technologies for the improvement of healthcare services. The EU actively promotes the digitalization of healthcare through various funding programs, including the Horizon Europe program (European Commission, 2021b).

## Results

The results of this study are categorized into three main subjects: eHealth challenges, prospects and applications and analysed in three regions: Cyprus, Greece and the EU.

### Challenges

In Cyprus, one of the most important barriers to adopting e-Health is the lack of interoperability between healthcare systems, as well as the limited development of telemedicine services. In addition, healthcare professionals do not have the appropriate skills to use digital health tools, which indicates the need for training programs. The lack of coordination between the private and public sectors limits access to medical healthcare services, while deficiencies in basic infrastructure make the implementation of e-Health difficult.

In Greece, the complexity of the healthcare system and limited financial resources prevent the effective implementation of EHRs. Similarly to Cyprus, the lack of interoperability and a legal framework that could allow the collaboration between different healthcare institutions is a major issue. Additionally, the insufficient

digital health training of medical and nursing staff is a key barrier to the successful adoption of e-Health solutions.

At the EU level, each Member State has a different approach to adopting e-Health, which prevents the adoption of common standards and makes the exchange of medical data across borders difficult. At the same time, the lack of unified legislative framework across countries results in regulatory barriers, limiting the effective implementation of e-Health policies. Some other critical issues affecting the implementation of e-Health in the EU include the high cost of IT system installation, the interoperability challenges, the complexity of technological applications and increased concerns about data protection and cybersecurity risks.

### ***Prospects***

Despite the existing challenges, numerous opportunities are emerging to improve the adoption of e-Health in Cyprus, Greece and the EU. Government initiatives, technological advances and policy changes are promoting the digital transformation of the health system. In Cyprus, eHealth4U is being implemented as a project that provides a digital health infrastructure while ensuring personal data protection. This project aims to integrate e-Health services at the European level, with the main prospects including the adoption of Patient Summary and e-Prescription, facilitating cross-border healthcare provision. Additionally, the expansion of eHealth4U has led to the development of MYeHealthAppCY, an application focused on telemedicine services. Given the current challenges in telemedicine implementation in Cyprus, this application could integrate additional digital healthcare services in the future.

In Greece, the main prospects include the improvement of IT infrastructure, developing secure data networks and expanding interoperability between healthcare systems. The PrescIT Project is presented as a potential platform that could be used to digitize e-Prescription, offering a more efficient and secure e-Prescription system. Furthermore, the expansion of telemedicine services and the integration of AI in diagnostic procedures are important prospects for the digital transition of the Greek healthcare system.

At the EU level, the full adoption of e-Prescription and EHRs are the main prospects of future strategies. Interoperability between national healthcare systems, the integration of robotics and the wider application of AI could also contribute to the future of healthcare across Europe. Also, strict compliance with the GDPR and European data protection regulations will ensure secure and controlled access to medical data. Moreover, the development of training programs for healthcare providers and the improvement of equitable access to healthcare are key priorities for European policymakers. Finally, continued support for research projects focusing on security and interoperability in digital health is crucial for the sustainable development of Europe's digital healthcare ecosystem.

### ***Applications***

Several e-Health applications have already been implemented in Cyprus, Greece and the EU, contributing to the digital transformation of healthcare and improving efficiency, accessibility and patient care. In Cyprus, the

most important e-Health application is the GHS, which was launched in 2019 and is a modern interoperable healthcare delivery system. Through this platform, electronic patient management and monitoring are facilitated, allowing healthcare professionals from different institutions to access EHRs. In addition, the e-Prescription system within the GHS enables paperless prescribing, enhancing patient safety, treatment effectiveness and medication monitoring.

In Greece, several e-Health solutions have been implemented, with IDIKA being the primary digital healthcare platform. Through IDIKA, citizens have electronic access to healthcare services, such as e-Prescription, automated medical referrals and digital patient records management. IDIKA functions as an integrated information system that ensures interoperability between healthcare providers and improves the quality and efficiency of the healthcare services. In addition, Greece has invested in the development of telemedicine systems, allowing patients and especially those in remote areas, to receive medical care remotely, reducing geographical barriers to healthcare access.

At the European level, the EU promotes the strengthening of interoperability and the integration of e-Health across Member States. Key initiatives include the e-Health Action Plan 2012-2020, which aimed to improve healthcare through technology, the EU4Health 2021-2027 initiative, which focuses on the development and implementation of innovative digital health solutions and Horizon Europe, which funds research projects for the development of digital health technologies. Moreover, the EU enforces the GDPR regulation to ensure the security and privacy of personal data in the e-Health sector. Another significant initiative, MyHealth@EU, enables the secure exchange of medical data and e-Prescription across Member States, facilitating cross-border healthcare accessibility. These initiatives aim to ensure the integrated, secure and interoperable provision of digital healthcare services across Europe.

## **Conclusion**

E-health is one of the most significant sectors of modern healthcare and offers numerous opportunities for improving healthcare services. However, its development, both in Cyprus and Greece, as well as in Europe, includes several challenges. Legal issues, lack of infrastructure and funding for its development, insufficient training for healthcare professionals, interoperability difficulties and personal data security concerns are significant challenges. Also, in Europe there are different approaches between the Member States and thus collaboration is more complex. Despite these challenges, e-Health presents great prospects for the future, especially in improving healthcare through investments in digital technologies. In conclusion, e-Health is the future of healthcare in Europe and its successful adoption depends on several factors. It is very crucial that technological development contributes to improving the quality of life of citizens and enhancing the efficiency of healthcare.

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