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e-Health Application, Implementation and Challenges: A Literature Review

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Abstract

Background: World Health Organization, through a partnership with European Union, encourages the implementation e-health systems. E-health is a relatively old concept that is upgraded with new technologies and is directed toward monitoring different health conditions with the help of technology. **Objectives:** This paper's main objective is to demonstrate e-health application possibilities in today's healthcare organisations and its impact on the quality of provided health care services using ISO/TR 14639 Health informatics Capacity-based eHealth architecture roadmap. **Methods/Approach:** In this paper, we used the e-health architecture model for literature review based on individual areas of the model - ICT infrastructure, e-health infastructure, health process domain components, governance and national ownership. **Results:** Research confirms that new technologies have a favourable and significant impact on population health; however, more developed countries show a better understanding of the concept and are moving towards implementing laws and regulations for e-health practices. **Conclusions:** Through this research, we concluded that new technology significantly impacts health, but this impact is limited due to different development of countries. That is why it is very important to develop health literacy, which is the ability to comprehend, access, retrieve, and use health information or health services.

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Introduction

E-health is a concept directed toward monitoring different health condition with the help of technology (Andrès et al, 2015) and is frequently used as an object of discussion and analysis when creating strategies and policies for health organisations (Showell et al., 2012). The concept of e-health began to be seriously considered in 1999 by combining electronic communications and technological achievements. Still, over the years, this term has been used more in merging different Internet technologies to enhance the quality of healthcare services (Oh et al., 2005). It can be said that e-health is a relatively old concept that has been upgraded with new technologies that arise with the development of Industry 4.0. New technologies important for the e-health concept are Big data, Artificial Intelligence (AI), sensors, the Internet of medical things (IoMT), drones, blockchain, etc. All mentioned technologies can be used to track a patient's status and inform the medical staff about it (Preuveneers et al., 2013). Eysenbach (2001) defines e-health as a field emerging at the nexus of medical IT, public health, and business, enabling improving conditions for providing public health services over the Internet and related Internet technologies. On the other hand, The World Health Organization (2003) defines e-health as the use of information communication technology to monitor and manage the treatment of users that use health services.

Many conceptual definitions are encountered in the literature, and each of them emphasises the importance of the Internet and Internet technologies in the context of expanding and providing adequate and user-demanded health care services. In recent work published in the last three years, e-health is often met by the term m-health, for which Barbabella et al. (2017) explain that it is an integral part of the e-health concept and is influenced by the development of smartphone technology. The development of Industry 4.0, as a result, enables medical staff to use different kinds of technology, like smartphones, to track patient status and to inform the medical staff about it (Preuveneers et al., 2013). But to use such technologies within healthcare processes, the organisation must conduct digital transformation, eliminating the traditional way of providing healthcare services and adopting a new way based on innovations that emerge from the technologies mentioned above (Haggerty, 2017). Using the concepts of m-health and e-health has several advantages but also faces some challenges. Scientific papers published so far are focused on understanding the term and possibilities of applying the concept, as well as examples of the introduction of the concept in healthcare organisations. For this reason, there is a need to look at the concept from different perspectives, including all the advantages, challenges, and opportunities that health organisations have by implementing some of the proposed e-health solutions.

The quality of life of today's society is decreasing with the ever greater influence and pressure of the environment. Quality of life has several determinants, psychic, physical, degree of individual independence, and its relation to the environment (Ruževičius, 2012). Consequently, healthcare organisations may have higher requirements for new approaches to providing health care. Success in meeting those demands correlates with the healthcare organisation's ability to adjust to the new requirements. The main purpose of this paper is to strengthen health systems in different countries and understand the importance of new concepts and technologies. This paper provides a holistic approach to e-health through the prism of quality of life. This paper offers a review based on the systematic architectural approach proposed by International Organization for Standardization.

The main objective of this paper is to demonstrate the possibilities and the challenges of implementing new technology within the healthcare system using

ISO/TR 14639 Health informatics — Capacity-based eHealth architecture roadmap. Through the proposed methodology, this paper offers a different approach that includes the relation between the implementation of new technology in healthcare and its impact on the quality of life of healthcare users. Also, the suggested framework is modified and showcases data collected through secondary research from relevant databases.

Following the proposed framework, this paper is divided into several different chapters. The first chapter has a background that explains terms and concepts important for understanding the e-health concept. The second chapter explains the methodology used in-depth, and the results are presented within the suggested framework in the third part. In the last part, there is a discussion and conclusion.

Background

About e-health concept

The importance of developing the e-health concept is recognised by the World Health Organization, which, through a partnership with European Union institutions, encourages the implementation of e-health systems (World Health Organization, 2016). It is important to point out that e-health is not just about the ability of health care users to explore and utilise available information about health conditions but also to arrange diagnostic, prognostic, research, auxiliary and other procedures that can be utilised to provide full service for healthcare users (Demiris, 2004). Table 1 presents an overview of the evolution of available health services.

Table 1
An overview of the evolution of available health services

Factor	Health 1.0	Health 2.0	Health 3.0	Health 4.0
Objective	Increasing system efficiency	Improving communication and productivity	Provide a user-focused solution	Real-time health monitoring
Focus	Easy automation	Connecting with other organisations	Interacting with patients	Integrated monitoring and diagnosis using artificial intelligence
Information Sharing	Within the organisation	Within a cluster of healthcare institutions	Inside the country	Within the entire supply chain
Key Technology	Administrative systems	Cloud computing	Big data	IoT, artificial intelligence, blockchain
Limitations	Limited functionality	Information sharing but the inability to interact	Different standards used	Privacy and data theft

Source: Adapted from Chanchaichujit et al. (2019).

The term e-health encompasses many different innovations and technologies based on the Internet and the Internet's potential. The e-health discourse encompasses the concept of m-Health, i.e. the use of smartphones as a means by which it is possible to perform some diagnostic or other activities.

However, e-health is not the only innovation available to today's healthcare hospital organisations. Through expert systems or sensors, artificial intelligence collects a lot of data. It creates so-called big data, enabling The digital transformation of healthcare organisations increases the flow of information through the system as much as increases the efficiency of such a system. But digital transformation also presents new challenges that come with the ability of third parties to make information about healthcare users available and to misuse that information.

The benefits of implementing e-health systems are primarily associated with financial savings. Research conducted in ten European countries has shown some financial benefits that the health care system has had after implementing the e-health system. With benefits associated with the health system, health care users are also susceptible to the positive impact of such a system. First, the benefits related to the safety in terms of making a proper medical decision about how a medical procedure is to be performed. Additionally, e-health provides easy access to information in all healthcare institutions with little or no probability that the information is not available now the user is on a contracted health check (Stroetmann et al., 2006). The implementation of e-health in the existing health system has several advantages starting with increasing efficiency and reducing costs, increasing the quality of the healthcare services provided, creating a new relationship between healthcare users and doctors as well as other medical staff and reducing the gap between health care beneficiaries who have financial resources and those who do not have (Raman et al., 2012). The applicability of the e-health system has shown particularly good results in countries where access to health care staff is low or none. In this case, e-health systems allow remote health services to open a medical facility, especially for settlements with insufficient populations (Naseem et al., 2014).

But, with some advantages, the e-health system has shortcomings. Lack of awareness of the need to integrate e-health systems into current healthcare systems presents difficulties and drawbacks. Additionally, the lack of information infrastructure, device-based innovation that can be used to support e-health data collection processes, and high investment costs are a challenge that some less developed countries can often not overlook (Adebesin et al., 2013).

When deploying an e-health system to an existing healthcare system, the available research suggests a series of requirements that must be met for successful implementation. First and foremost, it is necessary to define a strategy geared toward taking the steps required for implementation, which implies adopting policies geared toward developing the infrastructure and superstructures necessary for the normal functioning of such a system (Ross et al., 2016). Infrastructure and superstructure imply the development of electronic devices that will be used to monitor the health status, educate the operators involved in the e-health system, and develop databases and how the collection of collected data will be collected (Jin et al., 2018). Factors that encourage but may also be an obstacle to implementing e-health systems are technology availability, implementation costs, staff competence, policies and strategies (Ross et al., 2016). There are several different ways of using e-health. One of them is m-health, which is related to the possibilities of using mobile technology to track the health status of the healthcare user. With an increasing number of smartphones that today's sociality use, there are different kinds of possible usage of that kind of technology.

Furthermore, today's smartphones are equipped with different sensors that can be used for tracking healthcare status, such as heart rate (Preuveneers et al., 2013). With the growth of smartphones worldwide, more people are using m-heath to monitor their health. Additionally, there is an increase in the variety of applications that can

be downloaded to a smartphone and used to track a user's health state. These applications are particularly useful for groups of heart disease patients (Silva et al., 2015).

Health 4.0

The development of Industry 4.0 has the effect of creating innovations in all industries, including health. Industry 4.0 consequently has developed the so-called Health 4.0 concept that involves the application of technological solutions emanating from Industry 4.0 in healthcare (Estrela et al., 2018). Furthermore, with the development of Internet technologies and the ability to communicate through the Internet, many technological innovations developed within Industry 4.0 use the Internet to transmit information. Using the Internet with advantages such as availability of information, speed of data exchange, etc., also brings with it the risk associated with the security of information from third parties, which, if made available to them, could misuse the information. This is a particularly problematic area when it comes to healthcare to ensure the privacy of health service users.

The concept of Health 4.0 also implies the development of many other concepts related to the specific operations in healthcare facilities. For example, there is the development of Surgery 4.0, which improves communication within the team and the quality of surgical procedures performed. Surgery 4.0 uses a variety of automated systems, such as robots, that perform precise and complex surgical procedures (Feussner et al., 2017). Furthermore, Industry 4.0 affects the ability to deploy automated and robotic systems in healthcare and the ability to use technologies such as drones. The use of drones in the transportation of medical supplies or in the provision of assistance to injured persons in urban areas, where significantly more time is required for the arrival of an ambulance team. However, Health 4.0 also involves using artificial intelligence, which is used in expert systems through which medical staff can make a much more effective decision, that is, systems that make their own decisions based on the collected data. As a rule, data collection uses sensors that can be implemented in different places and systems, such as the so-called smartwatch, smartphone, smart TV, etc. (Javaid et al., 2019).

Using the innovations being developed within Industry 4.0, the digital transformation of hospitals and healthcare organisations is needed. Through digital transformation, such organisations are embracing innovations. Healthcare and hospital organisations benefit from improved communication, a higher quality of health care delivery, and consequently a higher quality of life for their users. Besides, the application of virtual and augmented reality enables significantly more effective education and extension of the competencies of medical staff performing medical and other interventions. The Health 4.0 concept is the result of evolution but also a revolution in technology and approach to service delivery. The table shows the evolution of the approach to healthcare delivery from the Health 1.0 concept to the Health 4.0 concept. The table shows how the focus moves from eliminating bureaucracy, i.e. unnecessary documentation, to monitoring the state of health care users in real-time and, according to the identified state, undertaking certain activities. Besides, new technology is making it much easier to disseminate information between all stakeholders in the supply chain.

However, it should be emphasised that Health 5.0 is expected to emerge through the development of Industry 5.0, which will certainly include collaboration between medical staff and advanced non-artificial intelligence-based automated systems. Furthermore, it should be emphasised that the development of the Health 5.0 concept will surely affect both the quality of the provided health service and users' satisfaction

with the health service. The E-health system is developing in parallel with the development of science and technology and because of increased demand for healthcare users. Particular importance and applicability of the e-health system are in situations where there is no adequate number of medical staff in the healthcare system that can respond to customer requirements.

Implementation of e-health systems increases challenges such as the need to educate future administrators, i.e. the operators who will be e-health management, and the need for infrastructure development that will enable the normal functioning of one established system. E-health and telemedicine systems are finding their applicability in different and numerous health states. In the future, we can expect an increase in e-health systems to be implemented in existing healthcare facilities. These systems' applicability will be in treating cardiovascular diseases, especially heart attacks (Saner, 2013). With the possibility of using e-health systems to treat various healthful apartments, the financial savings and the enhancement of the quality of healthcare provided based on information available through the e-health system are emphasised (Rooij et al., 2016). The e-health system application will enable all health care users to inspect their health status, based on information available through their smartphones or other devices specialised in accessing such information. Additionally, medical staff will be able to use scientific facts and recent achievements in the field or on the health condition they are trying to solve (Doupi et al., 2004).

E-health will also improve the standard of healthcare operations and the quality of treatment given to its users. Health organisations can develop, implement and rationalise e-health principles to reduce the operational costs associated with providing the required health services. This can result in increased patient flow through the health system, which means fewer waiting lists. In addition, implementing an e-health system will enable partial or complete elimination of the need for paper documents, which may result in the faster and simpler transfer of information obtained through diagnostic and other searches for healthcare users.

The recommendation to future researchers is to carry out primary research to explore the possibility of using e-health systems in countries where there are not enough users in the health care system. Still, there are waiting lists and research on the benefits of an e-health system implementation for healthcare organisations.

The development of Industry 4.0, in addition to enabling all organisations to transform and increase the efficiency of their healthcare delivery digitally, also enables them to increase the quality of their healthcare services. Increasing the quality of the health service provided can also increase the quality of life of the health service users. By using technologies such as big data, sensors, artificial intelligence, and automated and robotic systems, the healthcare hospital organisation can perform much more complex interventions that require significantly greater precision but, on the other hand, make significantly better diagnoses.

Methodology

This paper aims to provide an overview of ICT infrastructure and the health process of implementing e-health solutions. EHealth Architecture model presented by ISO/TR 14639-2 will be used to achieve this goal. ISO/TR 14639-2 describes eHealth processes, information, components and activities and is used to plan and improve health services through new technologies. Although this framework has a practical application, the basic components of the model will give an overview of the literature from individual areas of the model. This model is also proposed by Okereafor et al. (2020), Prodinger et al. (2017), Seebregts et al. (2017), and Taylor et al. (2015). The

eHealth architecture model (eHAM) comprises various component categories that are grouped under the following broad headings, shown in Table 2.

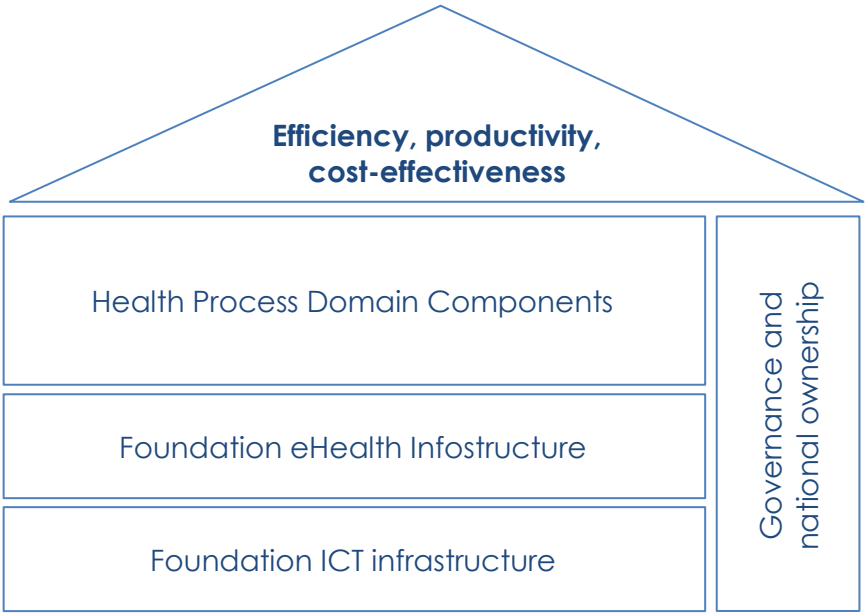
Table 2
Basic components of eHAM model

Category	Description
Foundation ICT infrastructure	Networking, servers, software, and IT professionals are basic IT technologies. Common standards, procedures, directives, and frameworks support foundational elements.
Foundation eHealth Infostructure	Data warehousing, consent and access control, data exchange interoperability, electronic health record repositories, and registries.
Health Process Domain Components	Patients who need healthcare services can access them through various processes involving the providers of such services. The health domains, which cover the continuum of care, include clinical (provider) assessment of health problems, diagnostic (test) assessments, treatments, and related elements, including payment for services and service evaluation, provider and patient education, and knowledge management.
Governance and national ownership	The governance and ownership category of the eHealth architecture model encompasses all organisational and governance components of eHealth, including funding, performance management, and the growth of local knowledge and capacity in health informatics. Infrastructure and infostructure both benefit greatly from standards.

Source: Taylor et al. (2015).

A simplified framework of eHAM is shown in Figure 1.

Figure 1
Simplified eHAM



Source: Authors illustration

The aim of the framework presented in Figure 1, according to Taylor et al. (2015), is to support nations and organisations in achieving the enhancements and advantages shown in the pyramid (at the top of the model)—more specifically, improved care quality and access, increased productivity, efficiency, and cost-effectiveness, well-informed health policy, and increased evidence-based practice. The model's components are created to be typical, optional, and adaptable to meet local demands when used in any specific eHealth service. As a result, this model provides a framework for developing further architectural models for eHealth family applications such as patient records, image management, mobile health, and Telemedicine. A literature review based on the individual areas of the proposed framework presented in Figure 1 is shown in the following chapter.

Results

Foundation – ICT infrastructure

The development of ICT and the growing trend of application and connection of known technological and technical narratives in a network developed a new sector of the industry, IoT, an acronym for the Internet of Things. In the context of e-health, IoT is used through sensors that can be used to collect user health information, which then can be stored in the associated database (Kodali et al., 2015). However, using IoT in healthcare and in general, brings several challenges associated with establishing secure communication between devices and databases. Since all devices are connected to a wireless internet connection, there is a risk of data theft (Tarouco et al., 2012). IoT design features and the technology utilised are linked to additional difficulties with IoT implementation in health systems. IoT devices require the existence of a constant power supply that will allow them a period of autonomy, which is the basis for proper and unobstructed diagnosis. In addition, the challenges are also related to technology and the microchips used to perform defined tasks of the IoT device (Sebestyen et al., 2014).

Despite the potential dangers and risks inherent in using IoT in the health system, several advantages bind to using this technology. One of them is better and significantly more effective control of the health care user's condition and the real-time ability to monitor his condition. In addition, the increase in the number of sensors that can be used in monitoring the condition can greatly facilitate the diagnosis (Maksimović et al., 2017). Furthermore, with the development of the Internet of Things, the Internet of medical things (IoMT), which is related to making the network of different medical devices, is also developed. Besides, IoMT can track the health status of the healthcare user and inform the medical staff about the user's health status (Alsubaei et al., 2019).

Several studies confirmed the correlation between ICT and better health outcomes. Majeed et al. (2019) conducted a study on the contribution of ICT to health outcomes. Three proxies—internet users, mobile cellular subscriptions, and fixed telephone subscriptions—are used in this study to assess the ICT infrastructure. The empirical data point to information and communication technology's an important and positive effect on population health. According to the findings, healthcare programs should focus on policies that promote digital inclusion. The effects of information and communication technology (ICT) on health outcomes in 30 Asian countries from 2000 to 2016 were examined in a study by Dutta et al. (2019). The study's key conclusions show that ICT significantly affects health outcomes in several Asian countries. Based on the findings, this study addresses certain critical issues associated with ICT and

recommends some crucial policy implications, mostly for emerging countries. ICT infrastructure (accessibility and availability) and health data (usage and sharing) were the two components of a cross-country health analysis that Seddon et al. (2017) conducted using multivariate statistical methods. This study's quantitative indicators/metrics suggest three separate country groups: frontrunners, followers, and laggards. These classifications emphasise the radically varied socio-political and economic contexts that national health systems face, where ICT infrastructure and eHealth capability will only help to relieve health inequities to a limited extent.
A study by Ud Din et al. (2017) examined the importance of information and communication technology (ICT) and e-governance in Pakistan's health sector, where these services are still developing. This study collected primary information from 170 patients at public and private hospitals in the Peshawar province of Pakistan. According to the research, e-governance in the health sector is still in its early stages. ICT is used for medical purposes by a relatively small number of people, and however, the total rate is low. A need for education exists. Other favourable conditions for deploying e-governance in the health sector include infrastructure, electricity, a good user interface, and data privacy and confidentiality.

Foundation – eHealth Infostructure

The possibilities of applying e-health systems are many and depend on the factors that make the health system in which e-health is implemented. The healthcare system for the healthcare user consists of a device connected to the database. From the database, at any time, it is possible to extract information about the user's health status. The operator, in most cases the therapist or other medical staff, may take appropriate measures depending on the registered indicator. The simplest example of a health monitor system is a system that monitors a user's state over a smartphone or a smart TV. Such devices are permanently connected to the database through an Internet connection, and medical staff can track the recorded state (Kotevski et al., 2016). The E-health system can also help the medical staff decide on the user's health status or therapy. This system is called CDSS, an acronym of the English word Clinical decision support system, i.e. a system for supporting clinical decision-making. CDSS contains a database on which medical staff can conclude or suggest a way to treat the identified symptoms (Dinevski et al., 2011).

One of the components of an e-health system is m-health. The m-health system is based on mobile technology. Today's smartphones incorporate a range of sensors that, with the help of applications, can track the condition of a healthcare user. The likelihood and popularity of such applications are correlated with their availability and price, as well as the user's awareness of the possibilities of their application (Handel, 2011). Another part of e-health is also Telemedicine. Telemedicine is an approach that enables communication and transfer of data and information at big distances between health care users and medical staff. Telemedicine may take place based on real-time interaction depending on the available link or available media used for data transmission (Craig et al., 2005). Increasing demands associated with establishing better communication between health care users and medical staff or medical institutions resulted in an appearance of the CHI, an acronym for Consumer health informatics. CHI makes it possible to use and better understand collected and obtained information about diagnostic and other examinations performed in medical institutions (Dey, 2004).

The applicability of the e-health system was tested in some European countries, and one of them is Denmark. By implementing EMR, an acronym for electronic medical records, the availability of information on the patient's health was facilitated, while the

health care institutions largely released paperwork. However, the healthcare workers must remain logged in with their username and password in the information system, which can lead to abuses of such systems (Kierkegaard, 2013). Poland has implemented artificial intelligence in its healthcare system, which has been trying to contribute to better and more efficient decision-making. Artificial intelligence in the healthcare system enables medical personnel to considerably facilitate diagnostics, i.e. easier decision-making based on collected data on patient status (Ziuziański et al., 2014). In Europe, many countries have implemented different forms of e-health. Benedict et al. (2018) identified 23 systems implemented in Germany, Italy, Belgium, Norway, Denmark and Poland. Implemented systems, or platforms, are linked to enhancing how healthcare organisations share information about the patient's health and assisting the medical staff's decision about treatment. An example of good practice is India, which applies the e-health system to enable direct communication with the healthcare user after performed operation, thus reducing the need for the user to go to physical examinations and counselling with a doctor. Besides, the e-health system also enables the training of medical staff without the need to leave their institution to attend a seminar or training. However, the application of the e-health system entails the challenges associated with the system's financial sustainability, which is correlated with the number of users using e-health.

Health Process Domain Components

Through health process domain components, several important areas are highlighted. Among them are payment, service evaluation, patient and provider education, knowledge management, and others. When using e-health systems, it is important to have health literacy. Health literacy is the capacity to comprehend, access, retrieve, and use medical information and services, according to Osborne et al. (2018). The authors contend that it is necessary to comprehend users' knowledge, skills, and experiences with current and upcoming systems. The level of e-Health literacy among university students studying medicine and health sciences in Mashhad, Iran, was evaluated by Dashti et al. (2017). The findings indicated a low degree of e-health literacy, and additional research is required to determine the factors that influence e-health literacy. Other research, made by Zhang et al. (2018), is focused on mobile healthcare applications (MHAs) that have been very popular in recent years, offering various innovative health services and information transfer techniques. The authors' article examined how users' perceived e-health literacy affects their motivation to keep using MHAs, developed on the elaboration likelihood model (ELM). The results show that ELM performs effectively in this model. The perceived level of e-health literacy significantly modifies the periphery route but not the centre. The most intriguing discovery is that perceived e-health literacy positively links to user satisfaction regarding continued adoption.

The financial aspect of the e-health system is also crucial. The relationship between alternative payment mechanisms (APMs), market competitiveness, and telehealth services in hospitals was the subject of research by Zhao et al. in 2020. The findings indicated that as clinical staff become more accustomed to using such technology, greater telehealth-related capabilities and deep integration into care-delivery systems under APMs present strong potential to improve clinical care quality and challenges. Authors Saranya et al. (2021) offer a Secure Authentication Protocol (SAP) payment over mobile in their study on e-health financing. To accomplish shared authentication between the server and the client, authors employ cryptographic techniques, which can be exploited to attack forged servers and falsified workstations. Compared to existing techniques, the suggested solution guarantees both distinct

privacy and the security of user account data as the payment industry transitions to mobile.

The safety of e-health systems is the most important when managing e-health systems. Through a study, Haryadi et al. (2017) provide a secure e-health system that depends on proving protocols to reveal and verify certain patient attributes while concealing others, thereby enhancing personal identity security. The experimental results showed that each proving protocol took less than a second to compute. Khan et al. (2018) assess the current methodology for ensuring the safety and security of a burgeoning and vital real-time e-health application domain. The approach is built on application and device requirements, including design and run-time elements. Given the application specification, the design component employs logical verification techniques to guarantee that the application architecture is resilient to faulty data. The authors use an example medical e-health application that controls and monitors blood glucose levels using an insulin pump to evaluate the methodology. A strategy for combining a cloud-based framework for monitoring electronic-health services is suggested by Kanchanadevi et al. (2020). With this, they hope to modify it for distributed computing. This framework has been upgraded to offer a larger variety of health services. The authors also integrate a security module to enhance patient privacy and safety in addition to this architecture. The proposed method improves access to health data while improving security, privacy, timeliness, and cost.

Governance and national ownership

Many countries around the world are developing regulations for e-health systems. E-health and electronic health records are being studied in Italy by Marino et al. (2020). As part of the reforms mandated by the Italian Government Law relating to the National Health Service, the nation is introducing information and communication technology, including eHealth and Electronic Health Records (EHR). This study's objective is to evaluate how widely used and accepted electronic health records are in southern Italy. The findings offer an early assessment of the usage of electronic health records, indicating that, in practice, electronic health records have yet to meet their goals and have had a lower influence on hospital operations than projected. Health professionals can create a coordination network to share knowledge and improve e-health standards across institutions. This phenomenon is viewed as an adaptable network-oriented standard governing paradigm for very large information infrastructures, according to Fossum et al. (2019). The authors advise e-health standardisation professionals to create profession-based network organisations that may operate as an intermediary between top-down and bottom-up standardisation operations to ease the inherent consolidation problem in standards governance in healthcare. De Pietro et al. (2018) are researching a new e-health strategy framework in Switzerland. According to the authors, as part of a larger e-health program that started a decade ago, Switzerland created a new federal law on patients' electronic health data in 2015. The reform compels hospitals to deploy interoperable EHRs to encourage data exchange and collaboration among healthcare professionals, resulting in healthcare quality and efficiency advances. Despite having the best intentions, the law's implementation was delayed by the significant institutional and organisational fragmentation of the Swiss healthcare system and a lack of complete stakeholder consensus on some crucial reform elements. Pilot trials showed that ambulatory participation is certain to be limited without the right incentives. Garmann-Johnsen et al. (2017) investigate the potential of e-health and welfare technologies. By identifying the essential characteristics that determine performance, the study contributes to e-health research. Government rules and laws have a

substantial impact on these elements. The author's findings cast doubt on the idea that welfare technology networks can be built from the ground up without governmental intervention. To get process performance indicators and foster innovation, regulatory interventions are required.

E-Health could enhance the delivery of healthcare services by enhancing communications, training the health workforce, and assisting with job-related duties and supervision. Additionally, the recent practice of precision medicine (PM) in low- and middle-income countries (LMICs) may assist in managing chronic diseases. Rayan's (2020) analysis focuses on mobile health's present developments, potential uses, and effects on people's lives in LMICs. It also exhibits awareness of the most effective methods for expanding electronic health (e-Health) initiatives in LMICs, guided by adaptation of knowledge from real case studies and assessment of the effect on developing and deploying future health initiatives, especially for women and children.

Discussion

There are different areas of e-health systems, and we used the e-health architecture model presented by ISO/TR 14639-2 to gather and categorise different research on this topic.

We simplified this model and used its main categories to give an overview of the literature. Based on conducted literature review, a summary using eHAM is presented in Table 3.

Table 3
Summary of the e-health literature review based on eHAM

Category	Results
Foundation ICT infrastructure	Studies made by Majeed et al. (2019), Dutta et al. (2019), Seddon et al. (2017), Ud Din et al. (2017) confirm the fact that information and communication technology has a favourable and significant impact on population health. However, critical issues associated with information and communication technology, mostly in developing countries, imply the need for some crucial policy implications.
Foundation eHealth Infostructure	Kierkegaard (2013), Ziuziański et al. (2014), Benedict et al. (2018) and other authors suggest that applying e-health systems depend on the factors that make the health system in which e-health is implemented. Also, the application of the e-health system entails the challenges associated with the system's financial sustainability, which is correlated with the number of users using e-health.
Health Process Domain Components	Osborne et al. (2018), Dashti et al. (2017), and Zhang et al. (2018) suggest that we need to understand users' knowledge, abilities, and experiences with current and upcoming e-health systems. Zhao et al. (2020) and Saranya et al. (2021) suggest alternative payment mechanisms for e-health services. Haryadi et al. (2017), Khan et al. (2018), and Kanchanadevi et al. (2020) present methodologies for ensuring the safety and security of e-health applications.
Governance and national ownership	Many countries are developing regulations for e-health systems; some practices are suggested by Marino et al. (2020), Fossum et al. (2019), De Pietro et al. (2018), and Garmann-Johnsen et al. (2017).

Source: Authors' work

These findings conclude that although information and communication technologies have a major impact on health, this impact is constrained by the varying levels of development worldwide. This research showed some critical issues in most emerging countries with underdeveloped health infrastructure. Providing health care services within highly populated urban areas is highly demanding. Those areas face challenges related to providing emergency health care services, but the roads that emergency response teams use are mostly crowded with cars and other vehicles. Some challenges are related to providing a safe connection between devices. This is crucial to secure the privacy of healthcare users and the privacy of employees providing healthcare services to the user. Research also shows that many countries are developing laws and regulations for using e-health, which can help manage this system more efficiently.

Many authors are looking at e-health and its application by describing the definition of e-health and considering different risks emerging from using technologies in e-health. This kind of perspective is very important to understanding the basis for e-health functioning. Other researchers in this area offer a practical use of the e-health architecture model and show different software used within health organisations. In this research, we wanted to overview important topics and components of the presented model. Additionally, this study goes into greater detail about the effect that e-health may have on the standard of care given to patients. Through four categories, this article covers a variety of experiences with e-health systems, rules, and regulations: ICT infrastructure, e-health infostructure, components and administration of the health process domain, and national ownership. This is secondary research, so it is limited in scope. However, we have shown that Industry 4.0 significantly impacts the quality of healthcare users provide.

Conclusion

In this paper, we described the possibilities of new technologies that emerged from Industry 4.0 in healthcare services. Technological innovations like RFID (Radio-frequency identification), IoT (Internet of things), drones etc. can increase the efficiency of today's healthcare organisations. New technologies can increase competitiveness in the market, so organisations that don't conduct digital transformation of business face many challenges. Through digital transformation, organisations can increase interested parties' satisfaction, leading to increased profit. It is important to emphasise that today's healthcare organisations face increasing demands for healthcare services because the quality of life in today's society is decreasing, which is correlated due to the increased stress level. Stress levels may determine new illnesses that will drive the need for creating a new way of managing them.

The practical implications of this research are related to all organisations considering implementing e-health technologies but are unaware of the benefits and challenges related to e-health. This research shows the most important aspects of building an e-health system. This research can also be used as a foundation to learn all the basic components of the e-health architecture model and to develop this system within different organisations. The presented model applies to all health systems. Since this model is developed and presented by ISO/TR 14639-2, it can help the institution in the different certification processes.

This paper's primary limitation is that it relied on secondary research, and the conclusion was based on research and data that is currently accessible. Future researchers in this area should conduct a primary study to identify the efficiency and

satisfaction of health users of healthcare organisations using traditional approaches and healthcare hospital organisations using Industry 4.0 innovations to provide services, such as big data (Connolly et al., 2018) or e-health records (Boilson et al., 2019).

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