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MINISTRY OF HEALTH OF UKRAINE
NATIONAL UNIVERSITY OF PHARMACY
faculty for foreign citizens' education
department of social pharmacy

QUALIFICATION WORK

on the topic **«JUSTIFICATION OF THE OPTIMIZATION OF THE USE OF MODERN TECHNOLOGIES IN THE CONDITIONS OF THE DEVELOPMENT OF ELECTRONIC HEALTH CARE SYSTEM»**

Prepared by: higher education graduate of group Фс19(4,10)-05
specialty 226 Pharmacy, industrial pharmacy
educational program Pharmacy
Saifia ROUA
Supervisor: associate professor of higher education institution of department of social pharmacy, PhD, associate professor Lyubov TERESHCHENKO
Reviewer: associate professor of higher education institution of department pharmaceutical management and marketing, PhD, associate professor Irina BONDAREVA

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ANNOTATION

Some of the main problems of developing countries related to the implementation and use of electronic health care systems are considered in the qualification work. Prospects for the use of information technology (IT) in healthcare organizations to reduce isolation in the world by connecting the community to the network via the Internet for ective implementation of organizational processes are determined. The prospects for the development of the latest IT in healthcare in Morocco are analyzed.

The qualification work consists of the introduction, three chapters, conclusions and the list of the studied literature.

The total amount of makes 52 pages of the text, including 11 tables and 20 figures. The bibliography contains 55 names of the studie.

Key words: health care, innovation, ehealth, electronic health records, e-prescription, modern technologies.

АНОТАЦІЯ

У кваліфікаційній роботі розглянуто деякі основні проблеми країн, що розвиваються, пов'язані з впровадженням та використанням систем електронної охорони здоров'я. Визначено перспективи застосування інформаційних технологій (ІТ) в організаціях охорони здоров'я для зменшення ізоляції у світі шляхом підключення спільноти до мережі через Інтернет для ефективного здійснення організаційних процесів. Проаналізовано перспективи розвитку новітніх ІТ у охороні здоров'я Марокко.

Кваліфікаційна робота складається з вступу, трьох розділів, висновків та літератури. Загальний обсяг складає 52 сторінок, у тому числі 11 таблиць та 20 фігур. Бібліографія містить 55 найменувань.

Ключові слова: охорона здоров'я, інновації, е-здоров'я, електронні медичні записи, електронний рецепт, сучасні технології.

CONTENTS

ABBREVIATIONS

AMR - Antimicrobial-resistant pathogens

CMIL - Casablanca Medical Informatics Laboratory

DALYs - Disability-adjusted proportion of years of life

EMA - European Medicines Agency

EHRs – Electronic health records

EU - European Union

GDP - Gross domestic product

GOe - Global Observatory for e-Health

HIV - Human immunodeficiency virus

LMIC - Low - and middle - income countries

MP - Medical Products

NHS - National Health System

NCDs - Non-communicable diseases

PC - Pharmaceutical Care

IT - Information technology

PC - Pharmaceutical Care

SDGs - Sustainable Development Goals

USA - United States of America

WHO - World Health Organization

INTRODUCTION

Relevance of a subject. Legacy systems with deep-rooted trends remain fundamental to the way healthcare organizations operate, and that's why keeping abreast of emerging technology trends is important today. Now it is relevant to smoothly integrate new technologies and give way to more advanced solutions. The main goal of the latest technologies is to improve the efficiency, productivity of healthcare and protect data while providing easy access for all segments of the population.

The relevance of the research topic is determined by the high potential of information technologies for improving the quality and accessibility of medical and pharmaceutical care for the population, improving education and the health care management system, as well as the insufficiently disclosed medical, social and economic opportunities for the systematic use of information technologies.

The healthcare sector is gradually but quickly adapting cloud computing technologies to its field. This is because modern world medicine, adhering to the main goal of patient-centeredness, formulates a key requirement for improving the quality of healthcare services and improving clinical outcomes (and therefore for improving the quality of life of a particular person and its prolongation): quick access to patient information regardless of location. Today, only modern technologies have tangible potential to meet this requirement. Digital health uses the latest information and communication technologies to develop and support faster, more efficient and more economical medical practice. This technological transformation of healthcare has become a global trend, the main tasks of which are to increase accessibility, comfort and quality of service for people around the world; timely, accurate diagnosis; in-depth medical analysis; and relieving health workers of routine. It is now possible to solve these problems with the help of high technologies only with the use of the allocation of serious computing power and technical support of IT specialists, which have become available to organizations of any size and direction of the healthcare system on the path of informatization.

Modern information technologies make it possible to investigate and connect the components of the activity of any enterprise or organization, including a medical institution. They are constantly developing, occupying ever wider areas of human life, therefore, any competitive and effective activity nowadays cannot be implemented without a detailed analysis of the possibilities of using the latest information technologies. Accordingly, one of the important components of any organizational and management activity is the information infrastructure, which is supported by a set of information resources and software and technical means.

To achieve the put purpose the following **tasks** of the research were definite:

- to analysis of concept innovation technology in healthcare system;
- to study of the main initiatives in the field of electronic health care in the European region;
- to analysis of organizational model for the development of e-health services in Morocco.

The subject of the study: scientific information about the strategy of health care reform in the world with the use of information and communication technologies, assessment of barriers and innovative developments for their implementation.

The objects of the study were IT statistics; WHO website, published reports of countries.

Methods of researches: research material was data from WHO reports, analyzed using analytical, comparative and generalization methods.

The practical value of the work was used in the generalization of the principles of IT implementation in health care institutions (example of Morocco).

Scientific novelty. Methodological principles were evaluated with an emphasis on optimizing the implementation of information technologies that can be integrated in individual countries to create an electronic health care system.

Structure and volume. The qualification work consists of the introduction, three chapters, conclusions and the list of references.

CHAPTER 1. PREREQUISITES FOR THE IMPLEMENTATION OF MODERN TECHNOLOGIES IN THE FIELD OF ACTIVITIES OF THE HEALTH CARE SYSTEM

1.1. Overview of the current situation in the field of health care

Healthcare and health systems around the world are undergoing intensive reforms. In today's more complex world, it is difficult to define health systems, what they consist of, where they begin and where they end. The World Health Organization, in its report on health systems in 2000, defined health systems as "all activities whose primary responsibility is to promote, restore and maintain health" [48].

According to WHO, in line with the Sustainable Development Goals (SDGs), quality is a key component of universal health coverage. To increase it, it is necessary to ensure financial risk protection, access to quality essential health services, and access to safe, effective, quality and affordable essential medicines and vaccines for all, regardless of income level. The healthcare industry is currently facing a variety of challenges, including an aging population worldwide, an increase in chronic conditions and diseases, resource scarcity, rising costs, and a growing demand for preventive health services.

Challenges to the health system – such as geographic inaccessibility, low demand for services, delays in care, low adherence to clinical protocols, and costs to individuals/patients – contribute to accumulated losses in the health system. These gaps limit the ability to close gaps in coverage, quality and accessibility, and undermine the potential to achieve universal health coverage. WHO estimates [46]:

– 1.8 billion people, or 24% of the world's population, live in fragile conditions that make it difficult to provide quality health services;

– between 5.7 and 8.4 million annual deaths in low- and middle-income countries are attributable to poor quality of care, accounting for up to 15% of total deaths;

– 60% of deaths are caused by conditions related to poor quality medicine.

The world's population has nearly doubled in the last 30 years, from 5.1 billion in 1995 to 8.1 billion in 2023. Most of the growing population is in less developed countries, i.e., between 3.6 and 6.3 billion [47,48].

But the most daunting demographic challenge facing the world is no longer rapid population growth, but aging. Declining fertility and increasing life expectancy have contributed to an increase in the number and proportion of people aged 60 and over. According to the World Bank, the share of the world's population over the age of 65 was a record 9.8% as of 2023, and the aging of the world's population has accelerated dramatically since 2010 [47]. In turn, the share of the world's population under the age of 14 reached its peak in 1966, when it was 38%, after which it has been steadily declining, reaching 25.3% as of 2023. There are currently 810 million people aged 60 and over worldwide, and by 2050 the number is projected to be 2 billion, with more people over 60 than people aged 14 and under [16,47]. In Table 1.1 we give a comparative description of the world population and of life expectancy in more developed and less developed regions in 2000 and 2023.

Table 1.1

Population and life expectancy comparison in 2000 and 2023.

Population comparison in 2000 and 2023			**Life expectancy comparison in 2000 and 2023**		
Comparison areas	2000	2023	*Life expectancy at birth*	2000	2023
Total world population	6,1 billion	8,1 billion	World	67,7	71,1
More developed regions	1,2 billion	2,0 billion	More developed regions	74,4	79,1
Less developed regions	3,8 billion	5,5 billion	Less developed regions	61,7	72,7

The number of young people aged 15 years and older people over 65 years old is distributed in a percentage ratio of 25 to 10, respectively. The youngest population lives on the African continent, but unfortunately this is not a positive thing. Africa has less than three percent of people over 65, indicating low life expectancy. Europe, unlike other countries, has a population over 65 years of age, 3 percent more than the younger population. (fig.1.1) [53].

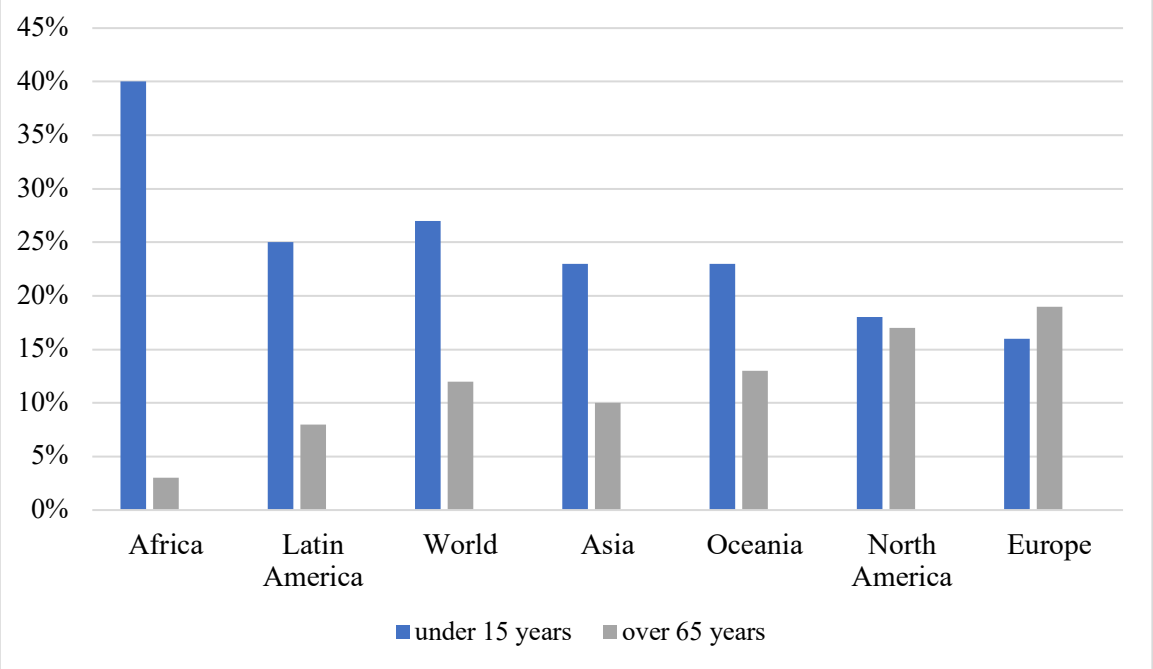


Fig.1.1 World population by age and region 2023.

The European forecast for changes in the ratio of adults to young people shows an increase in life expectancy. But by 2050, this trend is expected throughout the world and the number of working-age people will decrease.

The key indicators that are used to assess the level of healthcare in a country are those that are calculated for a certain number of the population (or potential patients). The healthcare industry around the world needs an additional 43 million healthcare workers to provide services to all those in need [12]. Health workers are “all people involved in activities whose primary purpose is to improve health” [45,55]. These people include physicians, nurses, laboratory technicians, public health professionals, pharmacists, and all other support workers whose primary responsibility is to provide preventive, promotive, or curative health care services.

Developing countries are committed in increasing health workforce to meet the WHO threshold of 2.3 heath workers per 1,000 people [41].

The number of hospital beds provides information about the capacity of hospitals to provide medical care, i.e., the maximum number of patients who can be treated in an inpatient setting at the same time.

On average, the number of beds per 100,000 people in the European Union was 515 and has decreased by 12% over the previous 20 years [44].

Table 1.2 shows a decreasing trend in hospital beds from 2000 to 2023 [39].

Table 1.2

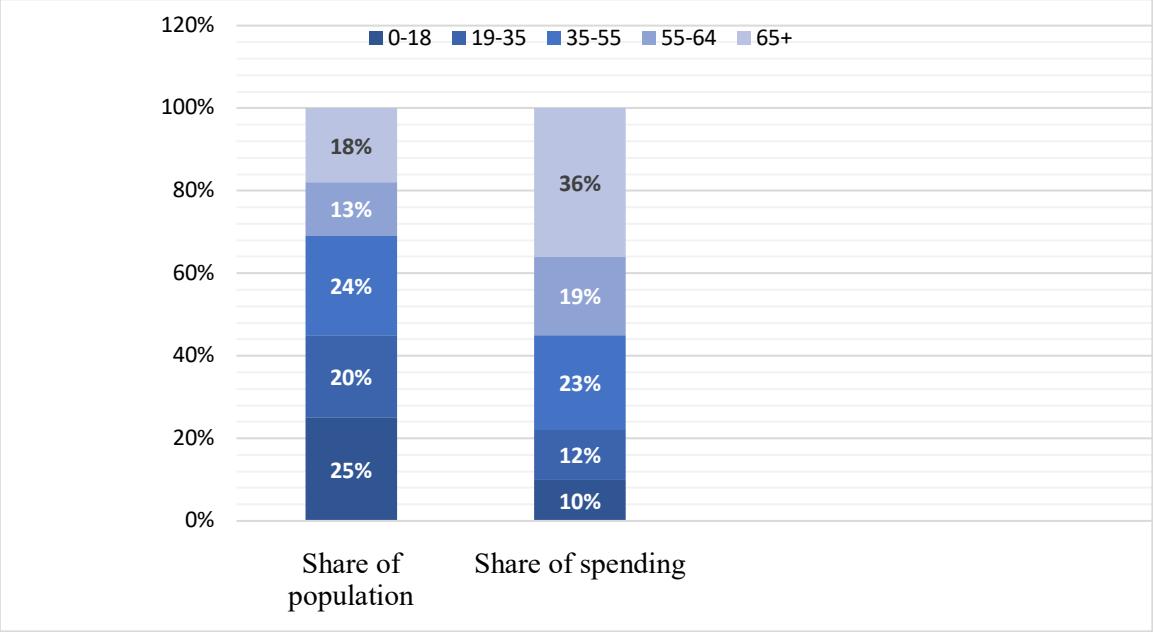
Beds per 1,000 population in 2000 and 2023

Hospital beds	**2000**	**2023**
World	5,5	4,8
High income countries	5,1	4,5
Low income countries	2,5	2,3

Health spending between countries also shows stark differences. In high-income countries, health spending per person averages more than US$3000, while in poorer countries it is only US$12 [41,54]. Sweden, Germany, France, Austria, Belgium, Denmark and the Netherlands had the highest levels of health spending relative to gross domestic product (GDP) in the European Union – more than 10%. Latvia and Romania spent within 5% of GDP on health, which is the lowest figure among EU members. WHO estimates that the minimum expenditure per person per year required to provide basic life-saving services is US$ 44 [24,54].

Total health care expenditures focus on averages, which focus on how people's health - and therefore their need to access and use health care - changes over the course of their lives.

Trends in health care expenditures across the population through lifetime medical expenditures are useful for our study (fig.1.2) [11,24,41,44,45].



Source: KFF analysis of 2021 Medical Expenditure Panel Survey data.

Fig.1.2 Share of total population and total health spending, by age group, 2021.

According to the European Centre for Disease Control for European Union countries, in 2013 the disability-adjusted proportion of years of life (DALYs) for diseases caused by infectious diseases caused by antimicrobial-resistant pathogens (AMR) was comparable to the number of DALYs due to diseases such as seasonal influenza, tuberculosis and HIV. According to the WHO, about 75% of infectious diseases caused by microorganisms with AMR are healthcare-associated infections. The percentage of cases of nosocomial infections in 2019 among all hospitalized patients in the EU countries ranged from 3.0 to 12.0%, depending on the level of economic development of the country [10,45]. These data indicate a lack of proper epidemiological surveillance, and therefore the inability to implement effective prevention measures and assess their effectiveness.

The challenges facing the global health system over the past 30 years have increased due to population growth and urbanization, behavioural change, the rise of chronic diseases, traumatic injuries, infectious diseases, specific regional conflicts, and the security of health care. Over the next 30 years, most of the world's population growth will take place in the urban areas of poor countries. Rapid, unplanned and unsustainable urban development will make cities in

developing countries key hotbeds of new environmental and health hazards. Changes will be noticeable in hospital design, culture, and practices to better meet the needs of patients, families, and healthcare providers. The main drivers of the global health system in the next 30 years will be the leading causes of mortality, non-health factors (the impact of nutrition, sanitation and women's empowerment), investment in the health workforce, and the growth of medical tourism in the future health scenario [14,16].

Thoughtful preparedness - a combination of behavioral changes, investments in human capital and infrastructure, policy and institutional reforms, and technological innovations - can help countries meet the challenges and take advantage of the opportunities presented by the world's changing demographics and challenges to health systems.

1.2. Concept of innovation technology in healthcare system.

Preservation, protection and strengthening of health and well-being of citizens is one of key responsibilities and priorities of every country in the world. The health of the population is very important for people to live a quality and fully fulfilled life its potential [49]. Solving public health problems is an obligation healthcare sector.

A health care organization is a cost-intensive environment, the level of which depends on the effectiveness of management.

Development of the health care system aimed at improving and developing the public health care system, in particular, guaranteeing availability and rational use in the state effective and safe medicines of appropriate quality, and provision population access to quality health care services.

The fundamental role of effective health systems is to ensure affordable, timely and appropriate access to health services for all patients. Therefore, its optimization can be defined as minimizing the cost of services, maximizing patient satisfaction, minimizing waiting times, maximizing equity policies and ensuring optimal cost efficiency. Well-built and well-managed health information systems constitute an essential part of providing good health care. One of the main

keys to improving the productivity of existing healthcare systems is the proper management and implementation of the latest information technologies in the healthcare system.

Modern technologies occupy an increasingly important place in all spheres of human activity, including healthcare. Modern healthcare organizations produce and accumulate enormous amounts of data. The quality of medical and pharmaceutical care, the standard of living of the population, and the development of the country depend on how effectively this information is used by doctors, pharmacists, managers, and governing bodies [6].

Modern healthcare technology is a broad term that describes the technology and infrastructure used to record, analyze, and share patient health data. Various technologies include medical record systems, including personal, paper, and electronic ones; personal health tools, including smart devices and apps; and finally, communities for sharing and discussing information.

Healthcare technology is any technology, including medical devices, information technology (IT) systems, electronic health record (EHRs), algorithms, artificial intelligence (AI), cloud and blockchain, designed to support healthcare organizations [6,10,18].

Initially, new technologies in the field of health care were used to support the activities of statistical, economic services, accounting, and thereby served internal institutional processes, optimizing the organization of work. At present, a number of methods based on the use of ICT have been developed, directly used in the process of providing medical care (remote diagnostics, teleconsultations), for its organization (electronic pre-registration for an appointment with doctors, electronic document management between the Ministry of Defense, maintenance of electronic registers for certain categories of patients), increasing its accessibility and efficiency [18].

Other methods, such as video conferencing, electronic monitoring of the implementation of critical health and social programs, are aimed at improving the management of health facilities and services. In the training and advanced training

of specialists, the use of distance learning methods has begun, including the distribution of educational and methodological materials, the conduct of electronic training courses, the creation of electronic medical libraries, which makes it possible to more quickly introduce modern achievements of medical science into practice, accelerates the introduction of uniform standards for the provision of medical care. All these innovations, influencing various links of the healthcare system, make it possible to more efficiently and rationally use the available material, technical, human and financial resources of the industry, to optimize the process of providing medical care [18].

Finally, a whole group of methods used to use electronic technologies belongs to the field of primary, secondary and tertiary prevention. These include, for example, the placement of preventive information resources on the Internet, the use of mobile telemedicine complexes during preventive examinations of the population in remote areas, the development and use of systems for out-of-hospital monitoring of the condition of patients, the organization of electronic schools for patients with chronic diseases, and others [18].

All this allows us to consider the set of electronic healthcare services, on the one hand, as an intra-industry innovation aimed at improving the quality and accessibility of medical care, and on the other hand, as a promising tool aimed at improving the health of patients and the population as a whole through the widespread development of prevention and possible early detection of diseases and their timely adequate treatment.

Most of the innovative changes in the health technology system were made during the development of medicine, but only digitalization has had such a strong impact. Improvements in computer technology and the spread of the Internet have expanded treatment options and changed the work of both doctors and pharmacists [32].

We have highlighted several examples of areas in which health technology innovation is supporting the next wave of healthcare advances (Table 1.3) [40].

Table 1.3

Innovative Healthcare Technologies

Health technology	**Description**
Precision medicine advancements	Relatively new tech trend in healthcare that entails a personalized approach to patient treatment
Better medical records	One of the most dramatic ways technologies in healthcare is having an impact: improving the collection and transfer of medical data. Consolidated EHRs make diagnosis more rapid, treatment more consistent and mistakes easier to avoid. Data networks are especially useful for regional and remote communities that may have less access to health infrastructure.
Faster drug development	The research process of developing drugs is cumbersome and expensive. Artificial intelligence has become more and more adept at finding new and more effective medicines. Many of the breakthroughs that are taking place in areas as diverse as cancer and HIV.
Telehealth	Distribution of health-related services and information via electronic information and telecommunication technologies. It allows long-distance patient and clinician contact, care, advice, reminders, education, intervention, monitoring, and remote admissions.
Blockchain	A shared, immutable registry that simplifies the process of recording transactions and tracking assets across a business network.
Artificial Intelligence and Machine Learning in Healthcare	Providing decision-making assistance for healthcare professionals in managing patient data. Processing huge volumes of data, tracking technology trends and providing information important for diagnosis and treatment.
Predictive Analytics in Healthcare	The advantage is anticipating needs and changing trends in patient care. Using sophisticated algorithms, it detects patterns in historical data and predicts potential health risks.
Mobile health	mHealth stands as an innovative and swiftly evolving domain within healthcare, leveraging the capabilities of mobile devices to extend the reach of telemedicine solutions globally. Recent years have introduced a new category of mHealth applications that prioritize users in the health data equation, empowering them with greater control over their data.

Computers were created in the middle of the 20th century, but they began to be used in medicine much later. As operating costs have decreased and

computer technology has continued to improve, system policies and healthcare organizations have considered their benefits and begun to introduce innovations in diagnostics and routine hospital operations [43]. Digitization of documents helped in the transition from paper to electronic media. Changes in operation have helped make access to patient medical data efficient and secure.

Gadgets are an integral part of the technological process; examples include health sensors and diagnostic scanners. As healthcare business processes have improved, procedures have improved and new treatments have emerged. Technology in healthcare is a critical player in the future of the industry. New technologies have changed not only the work of doctors and the entire healthcare system, but also ordinary users. An ordinary patient saves time by making an appointment with a doctor online and can get test results without coming to the clinic. We have highlighted the main advantages of new technologies for all participants in the process in the figure 1.3 [1,13,20-23].

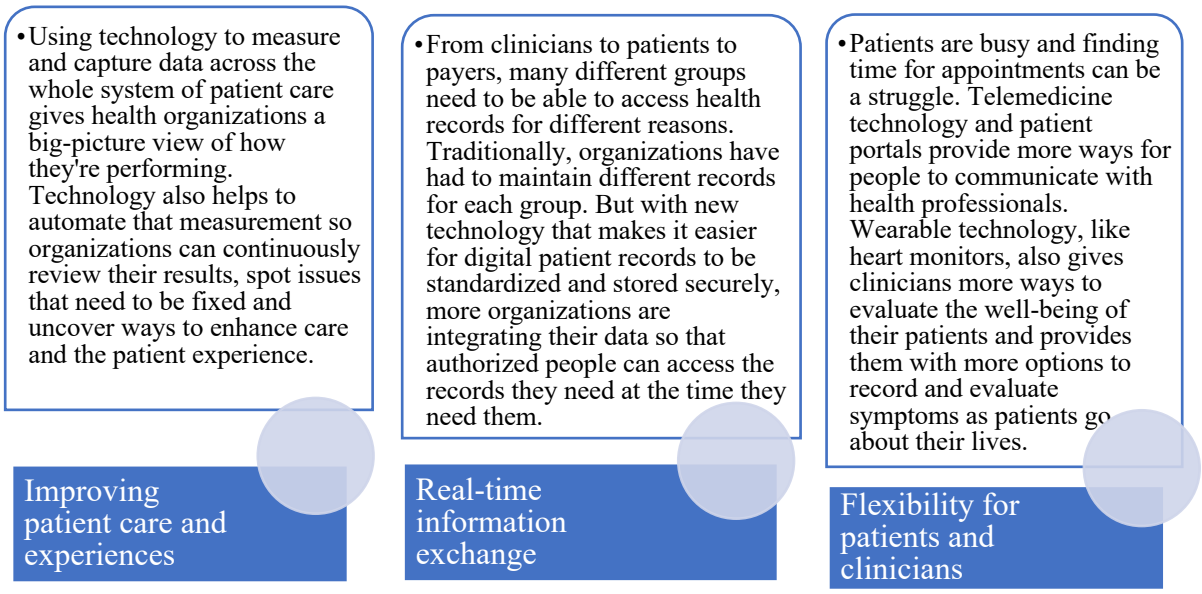


Fig.1.3 Benefits of technology in healthcare.

The introduction of new technologies in healthcare makes it possible to move to fundamentally new approaches to the provision of medical and pharmaceutical care. The modernization of the industry involves not only

electronic documentation, but also remote monitoring of human health, the formation of a single ecosystem of healthcare devices based on Internet of Things technologies, the robotization of many medical services and procedures, etc. The active introduction of new technologies is designed to increase the availability and quality of medical care while reducing costs. The information collected can be used for further analysis and the preparation of general and personal recommendations for prevention and treatment. Physicians can take advantage of medical decision support systems that minimize the possibility of medical error, solve routine tasks, and thereby focus doctors' attention on cases that require personal supervision. The variety of ways in which digital technologies can be used to support the needs of health systems is wide, and these technologies continue to evolve due to their inherently dynamic nature. Digital technologies introduce novel opportunities to address health system challenges, and thereby offer the potential to enhance the coverage and quality of health practices and services (fig.1.4) [20-23].

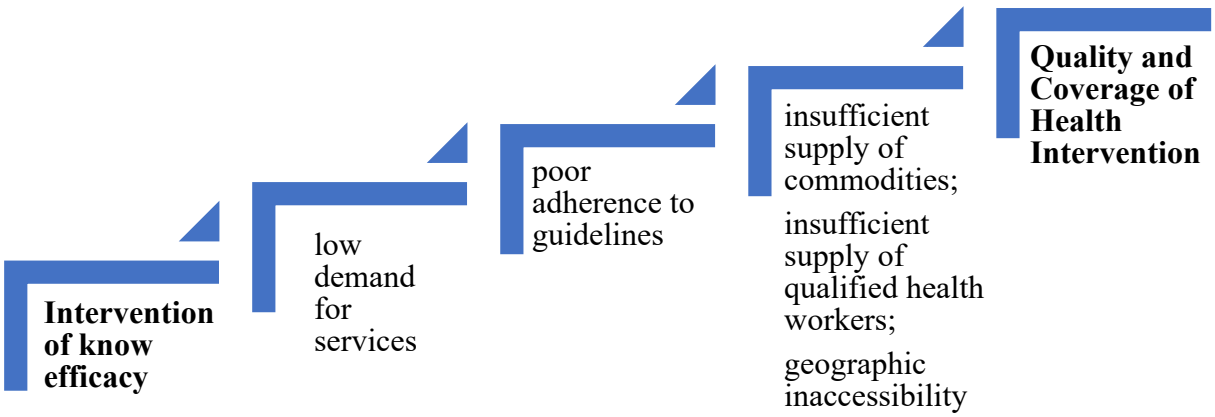


Fig. 1.4. New technology interventions in healthcare to overcome the challenges.

Digital health interventions can be used, for example, to facilitate targeted communication to individuals in order to create demand and expand the reach of

contacts. Interventions can also target health workers to provide them with more immediate access to clinical protocols, for example through decision support mechanisms or telemedicine, consultations with other health professionals.

A digital health intervention is defined as the discrete functionality of digital technologies and applied to achieve health goals [13]. The range of digital health interventions is wide, and software and technologies - digital applications - that enable the delivery of these digital interventions continue to evolve within the dynamic nature of the field. Starting point to categorize the various digital health measures used to overcome certain problems of the health care system (tabl.1.4) [20-23,50,51].

Table 1.4

Classification of digital health interventions

Need or problem to be addressed	**Classification of digital health interventions**	**Applications and ICT system**
Insufficient supply of commodities	Manage inventory and distribution of health commodities. Notify stock levels of health commodities.	Logistics Management Information System
Lack of access to information or data	Routine health indicator data collection and management. Data storage and aggregation. Data synthesis and visualizations.	Health Management Information System Electronic Medical Record
Loss to follow-up of clients	Transmit targeted alerts and reminders to client(s). Manage inventory and distribution of health commodities. Notify stock levels of health commodities. Longitudinal tracking of clients' health.	Client communication application. Electronic Medical Record

The benefits of digital health include disease prevention and treatment while reducing healthcare costs. Helping patients manage and manage chronic diseases. They also play a major role in the pharmaceutical sector by helping to

tailor medicines to individual patients. The result is increased efficiency of the overall health care system and improved medical outcomes.

Conclusions to the I Chapter

Based on the material studied, we can conclude that health systems often involve the use and manipulation of human resources, financial resources, technological resources and natural resources. The latest technologies are now an integral part of the process of medical and pharmaceutical care for the population of most countries.

An analysis of the world experience of introducing the latest technologies in different countries of the world is carried out. The world experience of introducing the latest technologies in health care has been generalized and their significant advantages and main directions of implementation have been allocated.

With the help of informatization, it is possible to transform health care and increase the level of patient safety, increase the efficiency of services provided in the doctor-patient-pharmacist system. Implementing and maintaining digitalization requires skills, so employees must make significant changes to both the office and the technological process, and require a long time to learn how to use IT. The most common automated system that greatly facilitates the work of medical and pharmaceutical professionals is digital healthcare.

CHAPTER 2. ANALYSIS OF THE CONCEPT OF INFORMATIZATION OF HEALTH PROTECTION IN THE WORLD

2.1. Analysis of modern technologies in the context of the development of e-health

With the internet's reach and data processing power on the rise, the global health business, and digital health in particular, has new growth opportunities. Automating hospital logistics is necessary to improve the efficacy of resource allocation and the delivery of healthcare demands and operations [9].

Examples of process optimization include reducing manual data entry through automation, eliminating redundancy in the supply chain, streamlining customer support processes to reduce response times, and optimizing manufacturing processes to minimize waste and reduce cycle times.

The field of protection health in some countries has already been digitized and works in a new format. The main goal of this sphere, nowadays, is to work in accordance with development strategies of digital healthcare. This strategy has the following main directions:

– changes and adaptation;
– decision-making;
– fundamental foundations;
– management.

There are many terms associated with digital health: eHealth, virtual care, telehealth, to name a few. In order to maintain consistency, the term eHealth is most often used. It provides solutions that strengthen health systems by bringing health services directly into the home and providing access to health care for underserved populations, by facilitating the detection of infectious disease outbreaks, and by integrating digital tools, which makes the process of providing medical care more efficient and effective [7].

eHealth encompasses a diverse range of technologies, including broadband connectivity, software, digital networking, big data, mobile connectivity, smart infrastructure and even artificial intelligence, which support the delivery and

improvements in health and medical care for individuals and communities. Its potential to improve service delivery for patients is just as broad, ranging from smarter, more cost-effective models of care, remote monitoring, improved access particularly in rural areas, rapid data analysis, which is helping shift the traditional treatment paradigm of ‘illnesses to a collaborative, proactive management of ‘wellnesses.

The term “e-health” is a general concept that covers a number of practical applications, we have highlighted the main technologies in figure 2.1 [1,7].

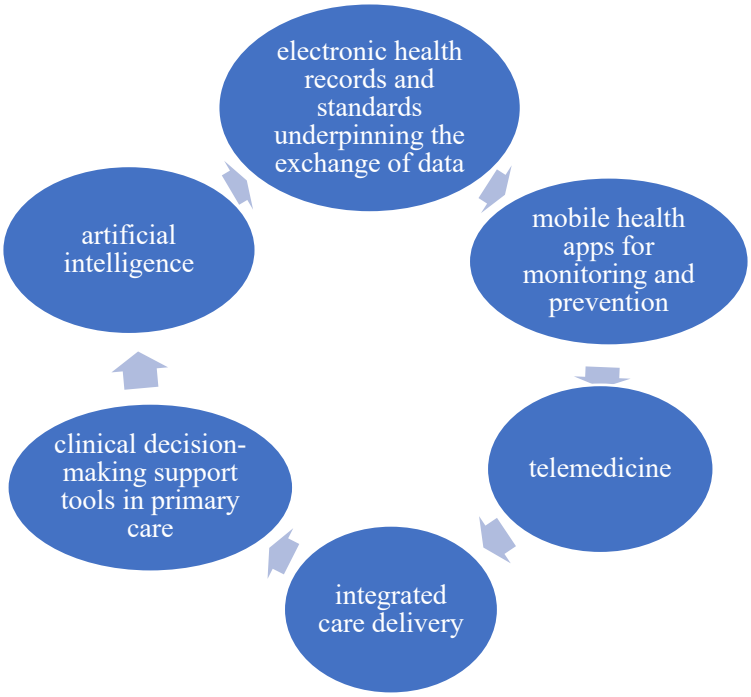


Fig.2.1 Areas of practical application of e-health.

Digital health links to other flagships, including behavioral and cultural insights and mental health, while seeking to build a partnership model to identify best practice and opportunities.

eHealth-enabled health services are uniquely placed to help reach those people who are currently not accessing services by overcoming issues of distance, cost and stigma. The digitalization strategy defines the key goals of e-health (tabl.2.1) [1,7,50]:

– for the patient - patients supported, well informed and actively involved in their health;

– for employees - employees have the tools to make effective decisions with access to better training;

– for healthcare organizations - organizations have ability for smart, transparent and effective management, business and service planning.

Table 2.1

Key eHealth goals for stakeholders

Patients	**Employees**	**Organisations**
Goal 1: Patients are well informed and supported by eHealth in achieving their health objectives.	Goal 2: Employees are assisted by eHealth to make effective decisions, access education and training, and deliver integrated models of care.	Goal 3: Organisations and health system performance is optimised and informed by eHealth.
Key benefits • ability to safely access and share agreed information with all relevant healthcare providers and agencies • easy and immediate access to health information and resources •personalised healthcare interactions and integrated models of care • new opportunities to engage with health providers through digital channels	*Key benefits* • intelligent applications to support clinical decision-making and patient safety • equitable on-demand access to training and education • enhanced personalisation of our peoples' experience with clinical and corporate systems • technology-enabled workforce support options (eg remote video conferencing, collaborative shared care tools) • enhanced tools to manage recruitment, workforce education, credentialing management and career development • better access to human resource information	*Key benefits* • analytics and insights to drive improvements in service delivery and planning, in particular safety, quality appropriateness of care • timely access to linked data from a range of sources • financial efficiency through improved operational performance • effective health data security and privacy management • optimised workforce management to ensure •support of individual organisations and Ministry of Health as a system manager in planning services, allocating resources and monitoring performance

Implementation of eHealth requires careful coordination between healthcare professionals, patients, caregivers and healthcare organizations. Precisely high-quality and comprehensive interaction is one of the most difficult to implement in practice elements of the implementation of such systems [20,38].

Innovations like the Electronic Medical Records for paper-lite digital documentation, HealtheNet systems for seamless information flow, a web-based learning management system, and collaborative bio-informatics and genomic medical research and training to support personalised translational medicine are already having a major impact for patients [21] (tabl.2.2) [52].

Table 2.2

Modern technologies in the conditions of the development of e-health

Areas	Description	Tasks
Electronic Medical Records (eMRs)	eMR securely shares information from all Health clinicians involved in a patient's care, to provide a more integrated picture of patient health acrossdifferent care settings including hospitals, community and outpatient care, or speciality and diagnostics services.	• core clinical documentation such as comprehensive clinical assessments, checklists, progress notes, clinical summary and medication history; • test ordering and diagnostic results; • electronic medications management
HealtheNet	Central clinical repository providing a statewide view of clinical history and seamless information-sharing between hospitals, community health, patients and private clinicians. Information includes patient demographics and identifiers, (including alerts, allergies and adverse reactions), inpatient, outpatient encounter listings.	•allowing patients doctors to view and share medical information between care settings to promote integrated care and the patient participation; •pay attention to coordination HealtheNet with Health Record information sharing standards for types of clinical documents including pathology, radiology reports, medical discharge summaries.

Table continuation 2.2

Areas	Description	Tasks
Incident Management System	Facilitates the process by which staff notify, document and manage incidents, near misses and systems risks through a user-friendly platform integrated with other Health systems.	The IMS solution helps improve real-time and consistent incident data entry while enhancing data quality and tools used to enable data analysis and reporting efficiencies.
Patient and Provider Video Conferencing	Virtual Consultations using video conferencing allow care providers to obtain broader input into a patient's treatment without requiring the patient to attend a face-to-face visit.	Video conferencing capabilities are already being used in some LHDs to improve access to specialists and reduce travel time in both rural and metro areas. In many cases patients are able to attend a facilitated consultation with a nurse where healthcare providers are not present in the same physical location.
Remote Patient Monitoring	Allows patient biometric information to be gathered remotely or at home so that it can be reviewed in conjunction with other information held in the patient record or shared care collaboration tools.	Remote patient monitoring regimes may be part of a recommended pathway for managing a chronic condition, set up as an alternative to hospitalisation, used to track the health of remote patients that cannot make it to a facility or used as a formal part of a care plan.
Availability and Access to Workforce Data	Workforce and business management systems provide the tools to enable to attract and retain the best talent, effectively utilise workforce, maximise capacity to deliver patient care and effectively discharge our duties as a public and private sector organisation.	Provides a basis for calculating analytical capabilities, as well as integration with other enterprise systems to provide accurate and up-to-date, manageable information based on historical trends and predictive analysis.

Rapid innovation in ICT is transforming how we engage with the community in the delivery of health services [13]. According to the Okinawa Charter of the Global Information Society, the latest technologies influence the formation of the society of our century.

Today, the data obtained with the help of IT are considered key elements of health care system reform, providing analytical support in decision-making and opening fundamentally new opportunities in obtaining, analyzing and evaluating information [27].

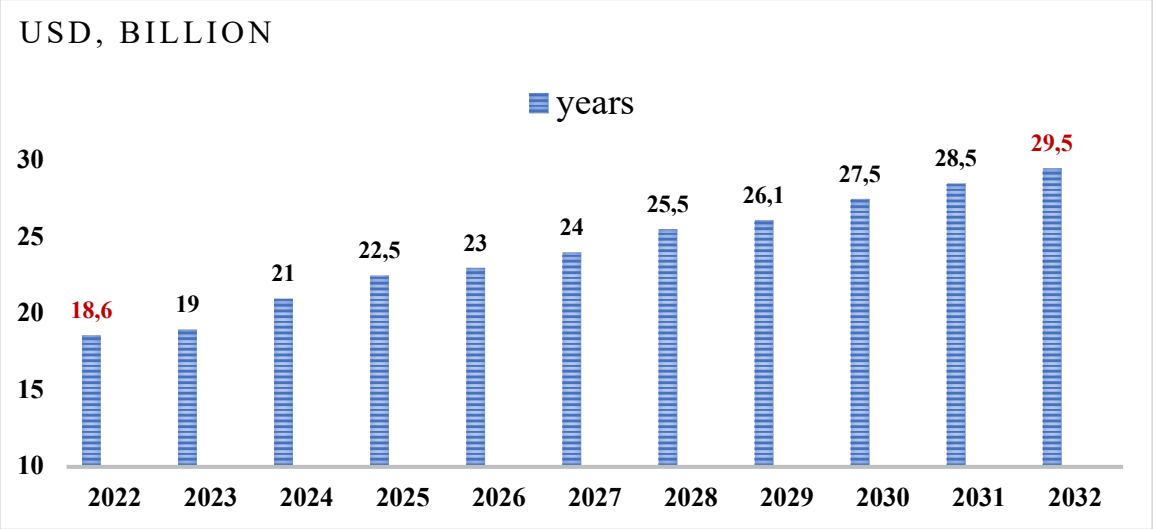
The e-health strategy identifies key areas to support its implementation. Each area of focus includes strategic investment priorities and initiatives, as well as specific implementation approaches technology platforms, e-health services and digital experiences. Fundamental principles are included and addressed as part of the planning, implementation and management of each initiative [32].

2.2. Analysis of the current state of healthcare informatization in the world.

In recent years, many countries have made impressive contributions to modernization national health care systems and the development of digital and telemedicine [33]. A special place in improving access and quality of medical services belongs to innovation. The use of computer technology in medicine worldwide began in the early 1950s with the rise of computers [4].

Currently, many countries (according to the latest WHO estimates, more than 60%) are developing and implementing their own strategies in the field of electronic health care [43]. In the USA, Canada, and EU countries, national health care informatization programs have been implemented for more than five years.

In 2022, the Europe Digital Health Market Size was valued at USD 18.6 Billion. The Market Size is Growing at a CAGR of 4.7% from 2022 to 2032, the Europe Digital Health Market Size is expected to reach USD 29.5 Billion by 2032 (fig.2.2) [11-15].



Source: Spherical Insights Statistics

Fig.2.2 Europe Digital Health Market.

All European states are aware that eHealth can provide more efficient health systems. They initiate activities and initiatives that encourage the development of e-health solutions [6].

In all EU countries, two main electronic cross-border health services are currently in use [15,42]:

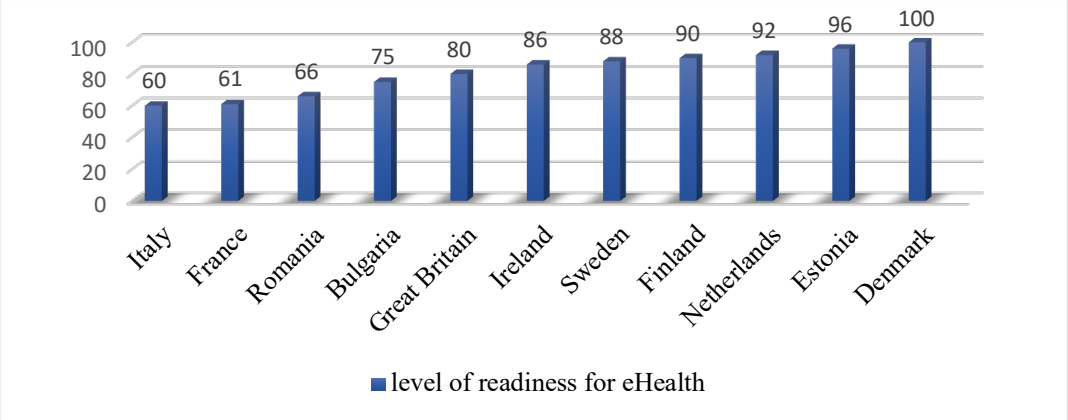
– e-prescription allows EU citizens to receive medicines at a pharmacy located in another EU country by transferring the e-prescription online from their country of residence to the country of arrival;

– a digital patient summary summarizes important health aspects (allergies, medications, previous illnesses, surgeries, etc.), being part of a larger health database (electronic medical record), and is designed to provide doctors with important information about the patient in their native language if he arrives from another EU country and there is a language barrier.

Thanks to the new digital services infrastructure, EU healthcare professionals can exchange data on the patient's health status; by 2025 it is planned to use such services such as exchange of electronic documents, medical images, results laboratory tests, extracts from the hospital, as well as a complete medical record patients in 25 EU countries. In the digital transformation of the healthcare sector, however, EU Member States are advancing at different speeds.

Particularly problematic is the uneven use of technology eHealth in different European countries [45,52].

The Institute for Competitiveness (I-Com) compiled a synthetic index in 2019 to give an idea of the level of readiness for e-health in European countries [42]. Denmark tops the ranking with a score of 100. Estonia, the Netherlands, Finland and Sweden immediately follow 96, 92, 90 and 88 respectively. Ireland and the UK have scores of 86 and 80 [34]. France and Italy are unfortunately not doing very well (with scores of 61 and 60, respectively) compared to most European countries (fig. 2.3) [7,51].



Source: I-Com development based on Euro Statistics data

Fig.2.3 EU Member States' level of readiness for eHealth for 2019.

For example, in Italy, patients and doctors are still not used to using a digital channel to interact with each other. Moreover, the digitization of the Italian national POPs is still highly fragmented, especially in some regions, and still lags behind most states [10,15,48].

Based on these data, it is possible to identify the factors that contribute to the development of eHealth in countries. We have identified the main ones:

– digitalization in doctors' offices;

– large number of patients using mobile and Internet technologies;

– infrastructure development;

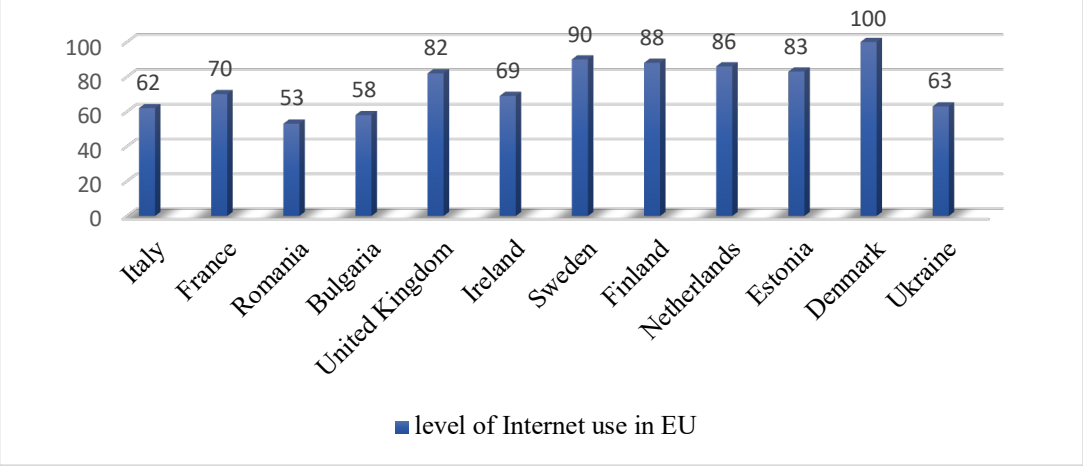
– best practice in cybersecurity.

Assessment of the level of implementation of informatization in POPs is carried out using the main indicators:

– the proportion of the population that uses the Internet to obtain medical information. In the developed countries of the world, this figure is about 90% [15]. In addition, about 65% of doctors receive up-to-date medical data (clinical protocols, standards, and medicines) through special certified portals on the Internet [14];

– the share of general practitioners who use electronic medical documents (the average in the EU is 35%, in the US 41%) [11-15].

The Internet has a profound impact on how healthcare facilities interact with each other and patients. Cloud storage, integrated procurement systems, and "social networks" that facilitate real-time communication within and between organizations help solve a variety of issues. Currently, for the eHealth system, access to the Internet is essential for daily activities. For many people in the EU, internet use is becoming an increasingly important part of their daily lives. The percentage of people who used the Internet on a daily basis in 2016 in European countries was 71% [11-15]. Based on the I-Com data, we analyzed the rating (fig. 2.4), which gives an idea of the level of Internet use in the EU countries. The ranking is based on twelve variables that are closely related to the digital society. For each country, the average value of the variables was calculated. The values obtained were normalized to the country with the best performance to establish a rating from 0 to 100 [11-15].



Source: I-Com development based on Euro Statistics data

Fig. 2.4 Internet usage index in European countries.

The undisputed leader in terms of volume and number of programs to support innovation in the field of healthcare (especially the biopharmaceutical industry) are the US. Currently time The Cures Act, signed on December 13, 2016, provides for a multi-year funding four highly innovative scientific initiatives [11-15,38,43]:

– creation and implementation of a large-scale research project “All of Us” by the National US Institute of Health, which allows you to combine, combine and analyze various data of biological, exogenous, social economic and geospatial nature, affecting individual prevention and treatment of diseases, allowing a better understanding of the causes of differences in state of health and the mechanisms of these features;

– data over one million people will become a valuable research resource that will be useful for generating new medical knowledge for people around the world;

– initiative "Brain Research through the Promotion of Innovative Neurotechnologies" aims to deepen the understanding of the mechanisms of encoding, storage and obtaining information from the brain for the diagnosis and treatment of neurological/psychiatric disorders;

– cancer Moonshot;

– an innovative project on regenerative medicine involves supporting clinical research in close coordination with Food and Drug Administration (FDA).

The experience of the USA is one of the vivid examples of the development of management in the field of protection health. The level of electronicization of the medical sector in the USA is at one of the first steps in the world. If back in 2017, the level of awareness of citizens regarding the "eHealth" system was is very low, then at the moment citizens are already happy use electronic offices [38].

According to the Global Innovation Index (2023), including 129 countries, first place in the ranking in terms of innovation efficiency Switzerland was

ranked, followed by Sweden, the USA, the Netherlands and the United Kingdom respectively.

A global innovation tracking system captures key trends in innovation investment, the pace of technological progress and adoption, and the associated socio-economic impact.

2.3 Analysis of the main initiatives in the field of electronic health care in the European region

eHealth has the potential to improve health care worldwide, and research should provide evidence of the effectiveness, safety, and added value of such interventions. For the successful implementation of the latest technologies in eHealth practice, it is necessary to anticipate obstacles. Based on reports from countries that have experience implementing the system, we have identified three barriers covering the topics of funding, human factors and organizational factors. Tasks remain relevant such as summarizing the current state and prospects for legal regulation of the use digital technologies in the healthcare system; achieving a balance between public and private interests; analysis of contemporary problems protection of the rights of participants relationship. According to the WHO and Toolkit National eHealth Strategy Guide, a country's national eHealth environment consists of five components of the enabling environment and two components of the ICT environment (fig.2.5; tabl.2.3) [50].

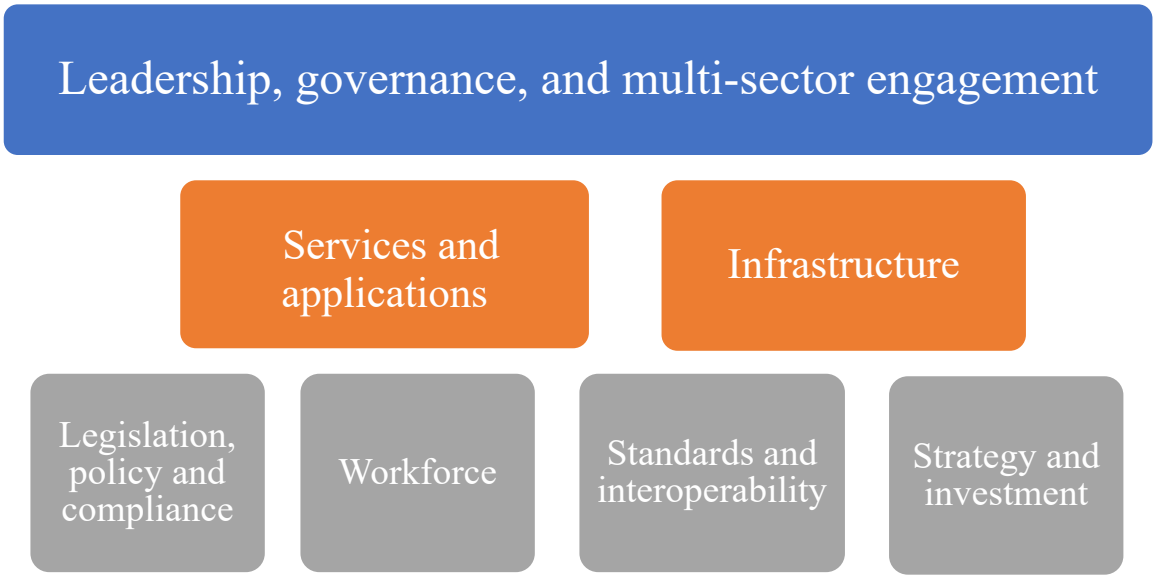


Fig.2.5 Components of a national eHealth environment.

Table 2.3

Components of a national eHealth environment

The enabling environment	**Components**	**The ICT environment**	**Components**
this provides direction for and coordinates e-health initiatives at national level; ensures the alignment of e-health with health goals of the country; provides political leadership and facilitate engagement with relevant stakeholders.	*Leadership, governance, and multi-sector engagement*	this creates the physical infra-structure that forms the foundation for electronic exchange of health information across geographical and health-sector boundaries.	*Infrastructure*
this provides for a responsive strategy and plan for a national e- health environment and aligns funding for e- health with national e-health priorities	*Strategy and Investment*	this provides the tangible means for enabling services and systems	*Services and applications*
this en- sures the development and adoption of na- tional e-health policies and creates the legal framework for the protection of the citizens.	*Legislation, policy and compliance*		
ensures that the necessary e-health knowledge and skills are available through internal expertise, technical coopera- tion or partnership with the private sector, as well the development of effective e-health education and training programmes to build an adequate health workforce.	*Workforce*		
this enables the adoption of standards that facilitate con sistent and accurate collection and exchange of healthcare information between and among care providers.	Standards and interoperability		

As noted in the Toolkit, the adoption of e-health standards ensures that healthcare information is accessible to authorized users as and when required [38,50].

Legal and regulatory issues are among the most complex aspects of eHealth: privacy, liability, and data protection are all issues that need to be addressed to ensure sustainable implementation and use of eHealth programs.

The implementation of electronic pharmaceutical services, as a rule, requires the adoption of specific legislation. Unclear regulations may hinder the successful use of eHealth technologies in practice. There is often a lack of clarity on legal issues. It is necessary to clearly define who is ultimately responsible for the online diagnostic system. More attention should be paid to legislative issues at the national level and in health care settings. Legal issues that may hinder implementation need to be identified early so that they can be addressed before the technology is fully developed: a good development process increases the chances of good implementation. A good development process pays attention to the values of users and other stakeholders.

European legislation has increasingly become a facilitator to innovation by supporting the dynamics of change while providing full protection and legal and ethical certainty. This is achieved in synergy with other enablers including standardisation clinical governance and through fostering security and quality cultures under an integrated framework of trust that is enforced and protected by law.

When an eHealth solution is the primary vehicle for delivery of care, then the legal and ethical issues are wide and will arise not only in terms of privacy and data protection, but also in terms of complying with competition rules and meeting safety and quality requirements. At the international level, the World Health Assembly of the World Health Organization and three of the six regional committees adopted a number of resolutions on e-health (tabl.2.4) [1]. These resolutions gave legitimacy to e-health as an area of activity of WHO and its

member states. The resolutions called on member states to start the work of relevant e-health services in their countries [53].

The WHO Global Observatory for e-Health (GOe) was an initiative dedicated to the study of e-health - its evolution and impact on health in the countries of the world. The observatory model provides for the coordination of WHO's work on regional and global levels to monitor the development of e-health worldwide with an emphasis on individual countries [13].

Table 2.4

The main WHO Resolutions regarding eHealth

Resolutions	**Main directions**
Resolution A58/28(2005) on eHealth	• the advantages, opportunities and directions of development of further informatization of health care are determined; • the potential of digital technologies to achieve the Sustainable Development Goals, and in particular to support health systems in all countries in promoting health and preventing disease, and by improving the accessibility, quality and affordability of health services.
Resolution WHA66.24 (2013) on eHealth standardization and interoperability	• recognized the need to standardize health data as part of eHealth systems and services; • supporting the interoperability of digital technologies in the healthcare sector, in particular by promoting the use of international and open standards as an accessible, effective and easily adaptable solution.

The conducted analysis of the modern legal framework regarding e-health allows us to state that it is rare for any country to report on a coordinated set of laws specially designed to address these various aspects. Rather, in most countries the use of eHealth is currently governed only by a general legal framework, including patient rights and data protection laws and professional conduct

regulations. New legislation is often still in the process of being drafted and adopted.

In 2007, legal activity related to e-health issues was registered in 14 countries. Today, 22 countries deal with legal regulations related to eHealth, demonstrating that this topic is now widely recognized as an important factor contributing to progress in this field [9,13].

Conclusions to the II Chapter

The digital transformation of society has penetrated into the medical field, which has led to the emergence of the concepts of Digital Health. Digital health includes mobile health apps, electronic health records, wearable devices, telemedicine, and personalized medicine. With the help of informatization, it is possible to transform health care and increase the level of patient safety, increase the efficiency of services provided in the doctor-patient-pharmacist system.

It has been found that a third of the population uses the Internet to search for information related to health and medicines. The penetration of digital technologies into the healthcare sector is carried out in three directions: the introduction of medical information systems, the use of information systems for monitoring the condition of patients and for diagnostic purposes.

The digital transformation of the medical sector is constrained by technical and social reasons. The former include the low level of computer and Internet access of medical institutions, while the latter include the low level of "digital" literacy of hospital employees and patients.

The two pieces of legislation that relate to eHealth are the Directive 2011/24/EU on the application of patients' rights in cross-border healthcare, and the General Data Protection Regulation.

CHAPTER 3. ANALYSIS OF PRIORITIES AND IMPLEMENTATION OF E-HEALTH PRINCIPLES AT THE NATIONAL LEVEL

3.1. Characteristics of the main activities of the national e-health system

E-health systems, which are active in developed countries, have recently begun to be implemented in developing countries at the levels of use in various health care institutions. These include computerization of patient records in hospitals and clinics, delivery of documents via the Internet, information exchange and communication, electronic records for patient identification, electronic scheduling system, hospital systems, laboratory testing and hospitalization, computer-aided diagnostics and treatment support. They are also used for decision-making in modern diagnostic laboratories. Each eHealth system creates a basic "infrastructure" of computers, networks, communications, and a technical department staffed by IT specialists to continuously maintain and improve the infrastructure, train physicians and other medical personnel, and provide ongoing technical support as needed [1]. Given the uncontrolled nature of technical support for eHealth systems, developing countries such as Morocco face the challenge of building full-fledged infrastructure facilities that are both competitive with the external environment and compatible with the internal requirements of users. In order to understand the essence of reforming the healthcare system, it is necessary to determine the reasons preceding this event. In the first practical stage of the work, we examined the current state of healthcare in Morocco.

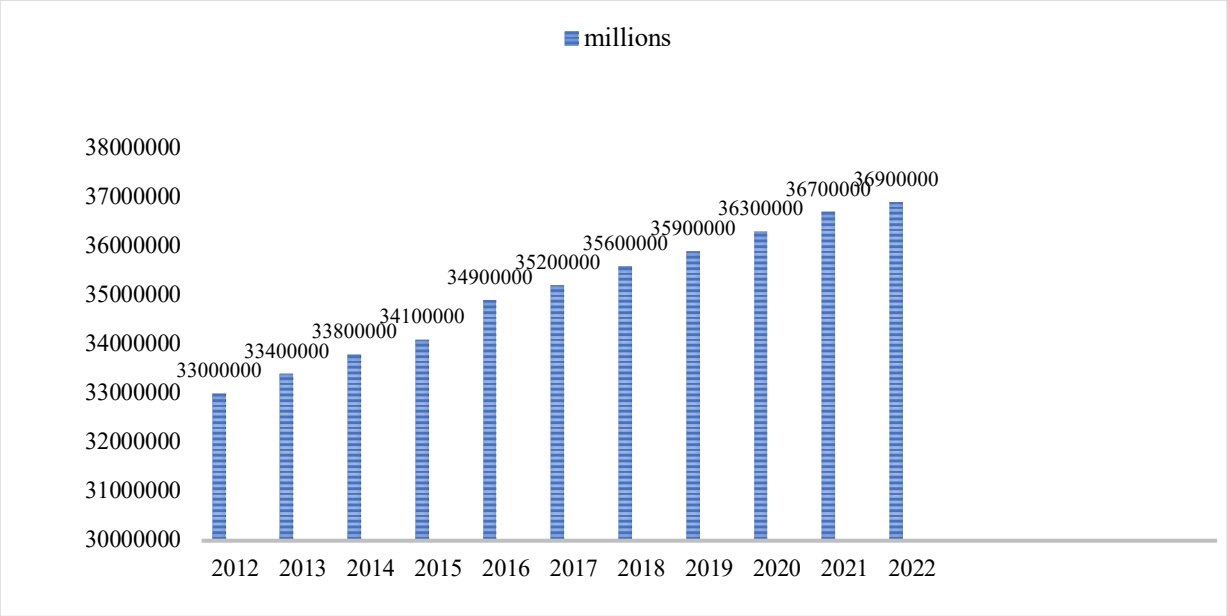
Moroccan Health System Challenges

According to the World Bank's 2022 criteria, Morocco is a lower-middle-income country. The Moroccan health sector, similar to other healthcare systems around the world, suffers from a shortage of human resources, which is desperately needed to increase efficiency and quality in healthcare [48].

In order to ensure human development and promote social justice, Morocco has undertaken a number of reforms over the past few decades, including

financial, hospital and institutional reforms aimed at improving the health of the population. This has made it possible to expand health care based on primary health care through prevention and vaccination programs to combat epidemics or control chronic diseases, as well as on quality hospital infrastructure and university hospitals to provide the country with qualified human resources.

The Moroccan population has almost tripled from 12.3 million in 1960 to 38 million in 2024 [37]. Morocco's annual population growth has fallen to 1.02 percent since 2012 (fig.3.1). Thus, population growth has reached its lowest level in recent years. In recent years, population growth has been steadily declining, this is due to the annual change in the total population and depends on factors such as fertility, mortality and migration [26].



Source: Statista, 2024.

Fig.3.1 Population growth in Morocco 2022.

Such a sharp reduction shows that the country is experiencing an accelerated aging process, which will lead to a gradual increase in the demand for medical services. To meet it, a significant expansion of health infrastructure, equipment and human resources is needed.

Public health indicators show life expectancy at birth estimated at 75 years (tabl.3.1) [26,53].

Table 3.1

Key health system indicators

Health status	**Number**	
Number of populations	38 million	
Life expectancy at birth in years	total	75
Adult mortality rate (probability of dying between 15 and 60 years) per 1000 population	males	141
	females	89
	total	115

The maternal mortality rate has decreased from 631 to 227 deaths per 100,000 live births, and the infant mortality rate from 80 in 1990 to 19 deaths per 1000 live births in 2022 [26].

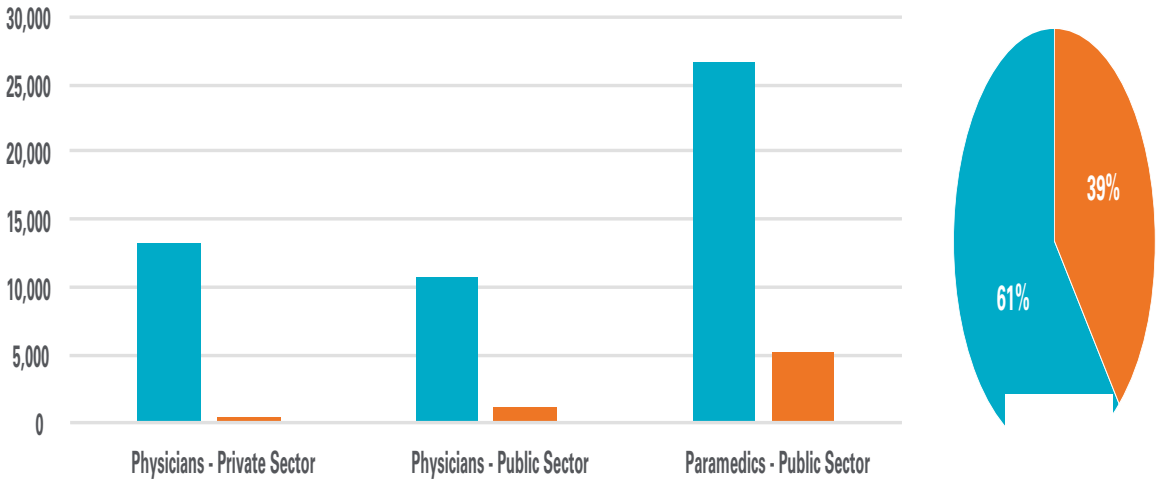
Despite undeniable progress, the national health system suffers from many shortcomings: including an increase in the chronic epidemiological burden, lack of human and material resources, very large regional disparities, a supply of health services that does not meet the criteria in terms of hospital capacity and health workers, and half-paid household funding.

There are also health facilities that are not equipped or only partially functioning, and almost the entire health care system is underutilized (the average employment rate is 56%) [26].

The World Health Organization places Morocco among the 57 countries in the world that have an acute shortage of healthcare workers. This serious shortage of health professionals corresponds to large disparities in distribution between and within regions, and between urban and rural areas [53].

Despite available infrastructure in both urban and rural areas, the number of medical and paramedical staff providing direct patient care in Morocco is well below the critical threshold of 4.45 care staff per 1,000 people. For 2017, the

Ministry of Health estimates the shortage of medical personnel at 32,387, and the shortage of intermediate medical personnel at 97,16118 (fig.3.2) [2].



Source: Based on data of the Ministry of Health of Morocco.

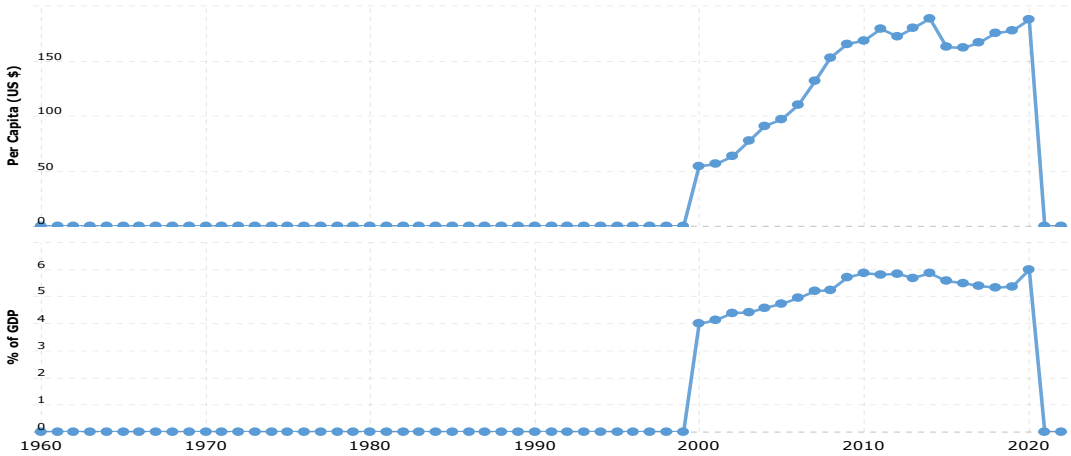
Fig.3.2 Distribution of Medical and Paramedical Staff in Rural and Urban Areas.

This under-utilization can be explained by the shortage of human resources at all levels of the system as well as by the low quality of services.

More than seven in ten Moroccans (71%) do not have access to an official health care provider. The average number of medical consultations per year is 0.6 contacts per person in urban areas and 0.4 contacts in rural areas. Seeking medical care is closely related to the distance that must be covered to reach a medical facility: the closer the center, the greater the average number of consultations per resident [28].

The share of total health expenditure to GDP increased from 4.0 percent in 2000 to 5.9 percent in 2020 [37]. Despite this increase, this share remains below the average of the WHO member-countries (6.5 Percent) and well below the average of OECD countries (8.9 %) [6].

The annual average expenditure on health per capita reached about $171.4 in 2013, spending for 2020 was $187 while the average for member- countries of WHO is $302.7 (fig.3.3) [43].



Source: World Health Organization Global Health Expenditure database.

Fig.3.3 Morocco Healthcare Spending 1960-2022.

In Morocco, there is a high prevalence of specific health problems, in particular gastrointestinal diseases, respiratory diseases, hematological diseases [22]. Some infectious and parasitic diseases are still widespread, such as tuberculosis, some perinatal diseases, human immunodeficiency virus (HIV) and other sexually transmitted diseases [25].

In addition, non-communicable diseases (NCDs) are increasingly prevalent in Morocco, posing a significant health burden [8]. NCDs account for more than 75% of deaths in Morocco, and the health system is ill-equipped to deal with these diseases (fig.3.4) [31].

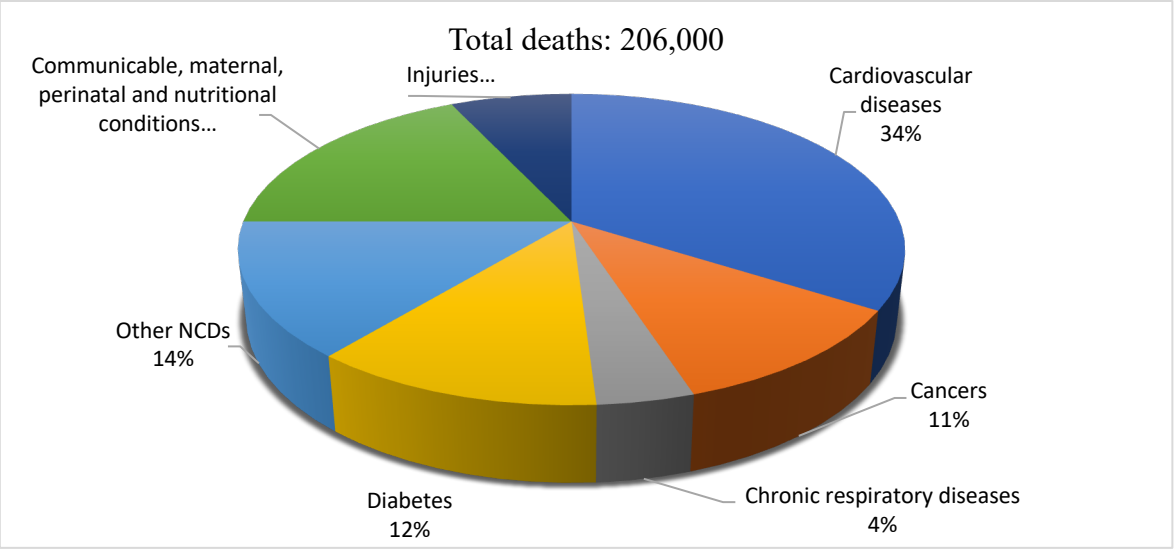


Fig.3.4 Proportional mortality (% of total deaths, all ages, both sexes) (2016).

Morocco's health system is addressing these challenges, and improvements are noticeable, especially over the past decade. Since 2018, Morocco has begun

to realize that the goal of universal health coverage is achievable beyond the country's level of development and that it is essential to carry out a large-scale and thorough reconstruction of the health system, combined with the acceleration of the generalization of basic health insurance and the introduction of modern technologies [36].

3.2. Functional and organizational model for the development of e-health services in Morocco

The use of information and communication technologies in medicine is a topic of great interest around the world and not just in Morocco. Indeed, digital health is one of the most hopeful areas for building health systems that can fill the gap in access to care, the shortage of human resources and the spread of universal health coverage.

There is a growing interest and activity level in health informatics within university hospitals and medical schools. However, to this date, there is one formal department of medical informatics within a medical school, the one in Casablanca, called Casablanca Medical Informatics Laboratory (CMIL) [35].
The main projects that Casablanca Medical Informatics Laboratory (CMIL) is involved in are listed in table 3.2 [55].

Table 3.2.

Main projects of implementation of medical informatics

Name of project	**Description**
International NetAdded Project	(new technologies to avoid digital division in e-divided areas) whose purpose is to create research centers to disseminate research results for the implementation of the European Community sixth framework program.
International EMISPHER Project	(Euro-Mediterranean Internet-Satellite Platform for Health, Education and Research) co-funded by the European Commission in the frame of the program EUMEDIS. It aims at promoting cooperation between Mediterranean countries [6].
‘e-App’ project with an engineering school (Ecole Nationale)	investigate innovations that address the problems and challenges raised by the medical community

Significant investments in clinical information have been made in recent years. The main goals of these clinical information systems can be grouped into three main categories:

– documentation and data recording relative to the various steps of medical care: diagnosis, prescriptions, and results;

– information dissemination: health information exchange, e.g., drug prescription must be exchanged with the pharmacy;

– support for administrative and medical decision-making: a dashboard allows analyzing medical activity, costs by patient, stay by patient, and other data analysis metrics.

Since 2008, the Ministry of Health's sector specific strategies have focused on the implementation of a computerised and integrated health information system, covering all of its missions and functions (ambulatory care, hospital structures, epidemiological monitoring and control, population health programs, medicine and pharmacy). Despite the number of projects initiated to this end, the current information system remains largely incomplete, heterogeneous, fragmented, compartmentalised and poorly accessible. Following an urbanisation study that exposed the current system's weaknesses, followed by the development of a master plan, the Ministry has pushed back the prospect of an integrated information system to 2030 [29].

At present, a national program has enabled several regions to initiate projects for hospital information system (HIS) projects in order to catch up with the university hospitals, some of which have reached a level of maturity allowing for optimal care monitoring and information sharing between healthcare operators and managers of these structures. The first strategic patient-focused e-health measures, such as telemedicine promotion, the development of e-health or the design and implementation of the shared medical record, will feature in the «2025 Healthcare Plan» [35].

To develop e-health, it is crucial to create a digitisation-conducive environment. Generally, this involves improving training programs for new

digital professions, setting up the necessary infrastructure, adapting regulatory frameworks and, most importantly, fostering a digital culture in the country.
The challenge of a digital transformation in the health sector is also to convince and bring on board currently low digital users, particularly vulnerable populations that are generally most undermined by the digital divide.

Finally, the e-health project's success should be based on a participatory and patient- focused approach, mobilising all the e-health ecosystem players around the core player, the Ministry of Health, in order to take stock of the current status of actions already undertaken, the challenges and issues faced by each of these players, as well as their expectations and perspectives in this regard [30].
The main goal of this project is - the patient is at the center of the technological process (fig.3.5).

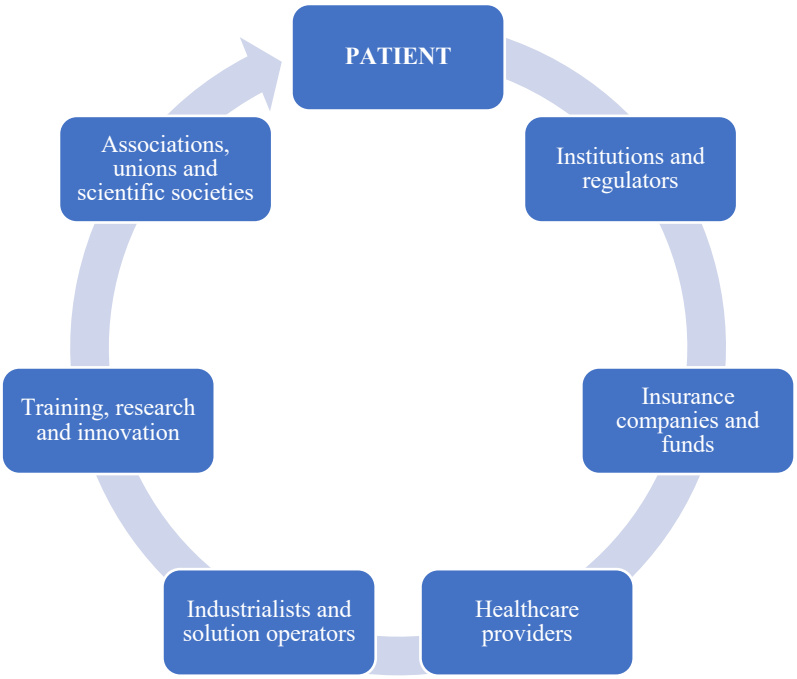


Fig.3.5 Breakdown of e-health actors in Morocco.

A 2020 High Tech Health study estimates that the health technology sector in Africa is booming, especially after the increased investment in this sector spurred by the Covid-19 pandemic. The African continent has 180 start-ups active in health technologies out of a total of 397. This has triggered an exponential 58% increase in the capital of HealthTech start-ups during the 2019-2020 pandemic

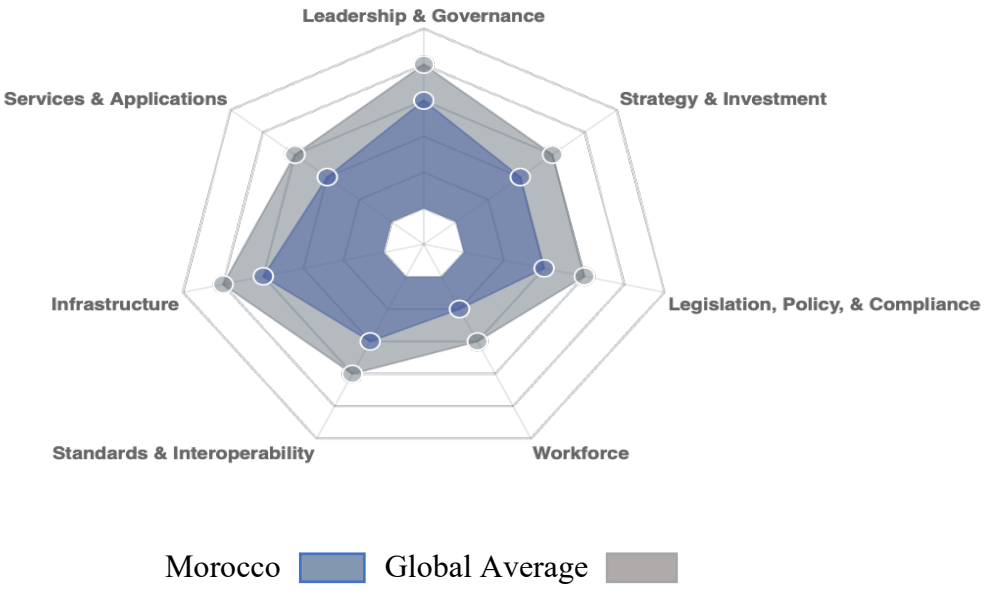
[55]. The eHealth (HealthTech) sector is related to the areas of digital, start-ups, innovation and investment in general. eHealth cannot be separated from the overall context of these concepts.

In Morocco, the medical technology environment is very modest, with only a few outstanding experiences gained from individual initiatives.

The HealthTech sector in Morocco can be divided as follows [3]:

– Biotechnology: companies that develop new drugs, biodiagnostics, cosmetics, or new treatments;
– Medtech-Medical Technologies: companies developing new medical equipment;
– Digital HealthTech: companies that develop services or software in the field of medicine based on digital technologies.

Generally, the start-up ecosystem in Morocco is considered an emerging innovation hub. The Global Innovation Index (GII) provides a diagnosis of Morocco's multi-dimensional innovation factors based on 80 indicators, to rank it 75th among 131 economies, as presented in the World Intellectual Property Organisation's 2020 report (fig.3.6) [15].



Sources: Global Digital Health Monitor.

Fig.3.6 Overall Digital Health Phase.

Morocco has the highest rates of incorporating digital health or e-health into its national health strategy. Draft digital health strategy or framework developed, but not officially reviewed. Health system registries of uniquely identifiable providers, administrators, and government agencies are available for use but are incomplete, partially accessible, and not regularly maintained. The plan to support the provision and maintenance of digital health infrastructure (including equipment – computers/tablets/phones, consumables, software, devices, etc.) has been implemented partially but not consistently, with an estimated 0-25% of the required digital health infrastructure needed in the public health services sector being in place and in use [15]. But its weakest scores, which can be considered a decline in attractiveness, are related to the digital health curriculum for healthcare professionals as part of the pre-training requirements. There are no protocols, policies, frameworks or accepted processes in place to support secure cross-border data exchange and storage in support of public health goals while protecting individual privacy. We have listed the main responses made possible by e-health in Morocco in the table 3.3 [5].

Table 3.3

Responses made possible by eHealth

Information and communication technologies	**Telemedicine**	**Tele-consultation**
• digitisation of medical data, • optimised and efficient data exchange, • rapid access to the patient's records at any time, • coordination among experts, • secure storage of the patient's data history.	• prevention of chronic diseases and hospitalisation needs, • reduction of face-to-face consultation constraints, • medical servicing of remote areas.	• patient empowerment, • building the patient's capacity for self-management, • automation of consultation processes, • optimisation of care pathways, • cost containment.

The aim of our study was to identify different levels of use and predictions for the rapid development of digitalization in health care in Morocco. Identify opportunities, challenges, security, privacy, ethics, efficiency, governance, etc.

Next, using the reports of medical organizations, we assessed the level of digitization of professional data in subjects.

The first finding is the strong disparity existing between the private and public sectors in terms of digitization [3]. In the public sector, nearly half the organisations continue to process data in the traditional way, at a rate of 75%, while organisations with a digitisation rate over 75% represent only 11% of the total number of organisations surveyed. Private organisations seem to be more committed to digitisation: organisations that are 75% digitised represent nearly 21% of the total, twice as many as their public counterparts. It should also be noted that nearly 42% of private organisations have successfully digitised at least 50% of their data processing (fig.3.7) [3,55].

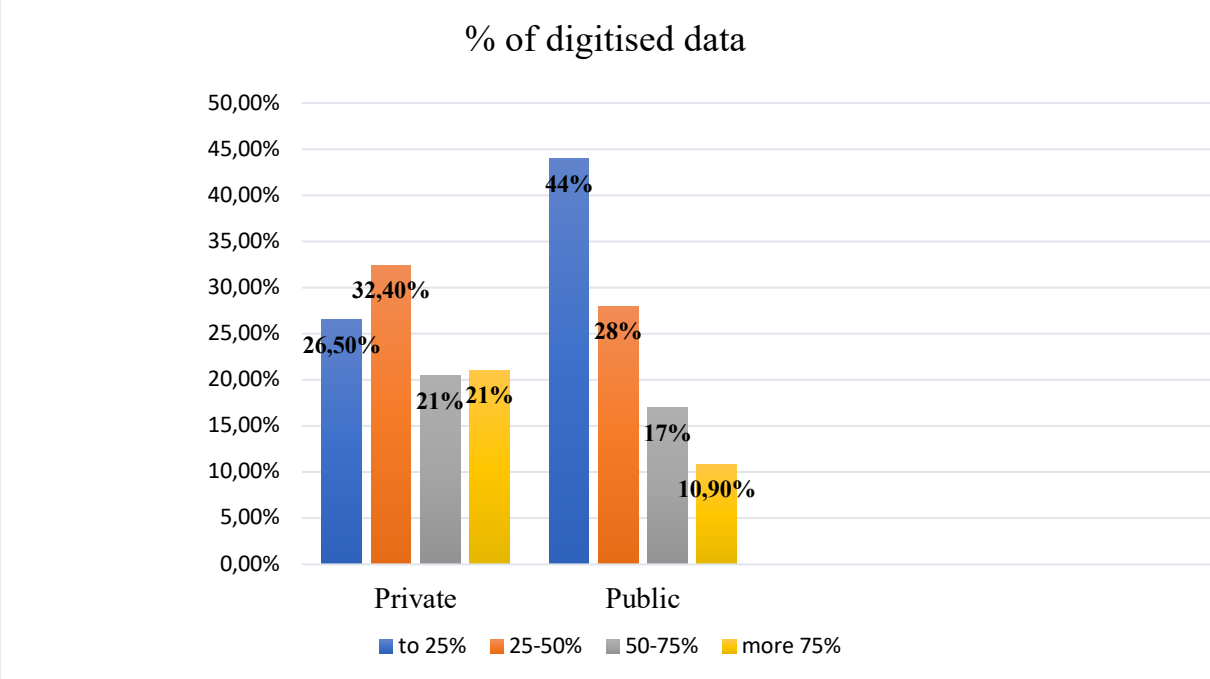


Fig.3.7 The level of digitalization in medical institutions.

The main priorities of electronic health care, which most specialists use most of all, is the patient's electronic card (85%); training of doctors (e-learning) and telemedicine equally by 52%; implementation of specialized clinical solutions takes 25% and e-prescriptions are used at the level of 35% (fig.3.8) [55].

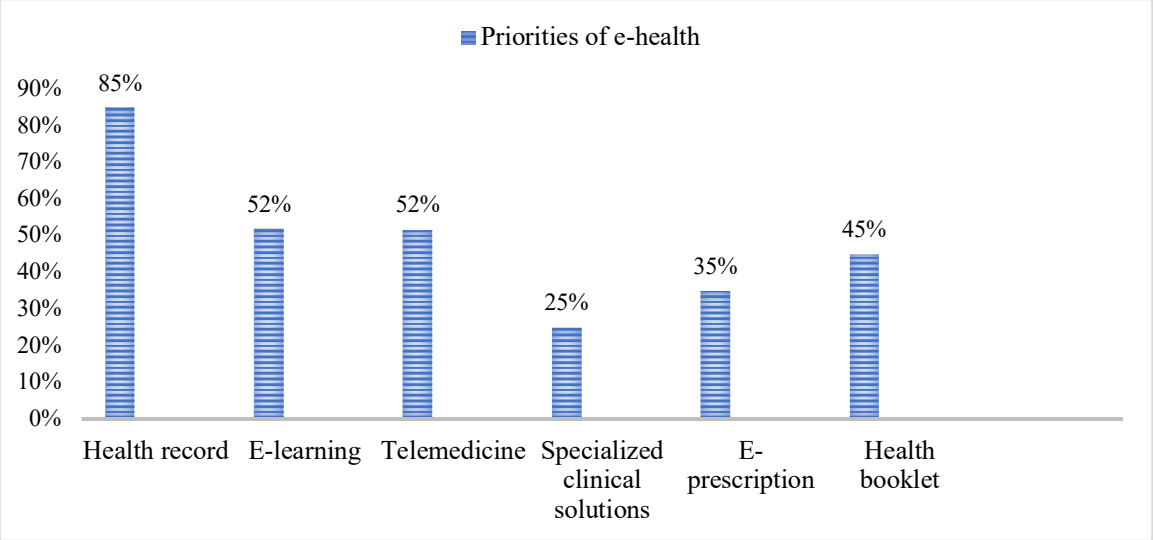


Fig.3.8 The main priorities used in e-health.

The Electronic Health Record (EHR), a modern advancement over the old paper medical records, has emerged as a central component of information systems and a tool to improve the quality of health care and the efficiency of healthcare professionals by providing them with quick access to structured information. Electronic health care will significantly reduce workload, allowing healthcare professionals to focus more on care and management.

Unfortunately, a single patient registry used by all authorized service providers is only being formed and needs to be expanded for the use of EHRs in medical and hospital structures and even generalized to their use on a national scale. Medical professionals use and exchange patient health data with hospitals and private clinics (58%), followed by medical testing laboratories (37%). In Morocco, it was these sectors that engaged in early digitization, implementing hospital information systems and laboratory information and management systems. It is important to note that electronic exchanges with health insurance and mutual insurance organizations remain low (18% of specialists), which limits the possibility of remote submission of claims, as is the case in some European countries. There are also current difficulties in obtaining complete and updated real-time health information on a national scale, especially regarding epidemiology (22%). Interestingly, electronic exchanges with pharmaceutical organizations remain low (only 15%) (fig.3.9) [29,55].

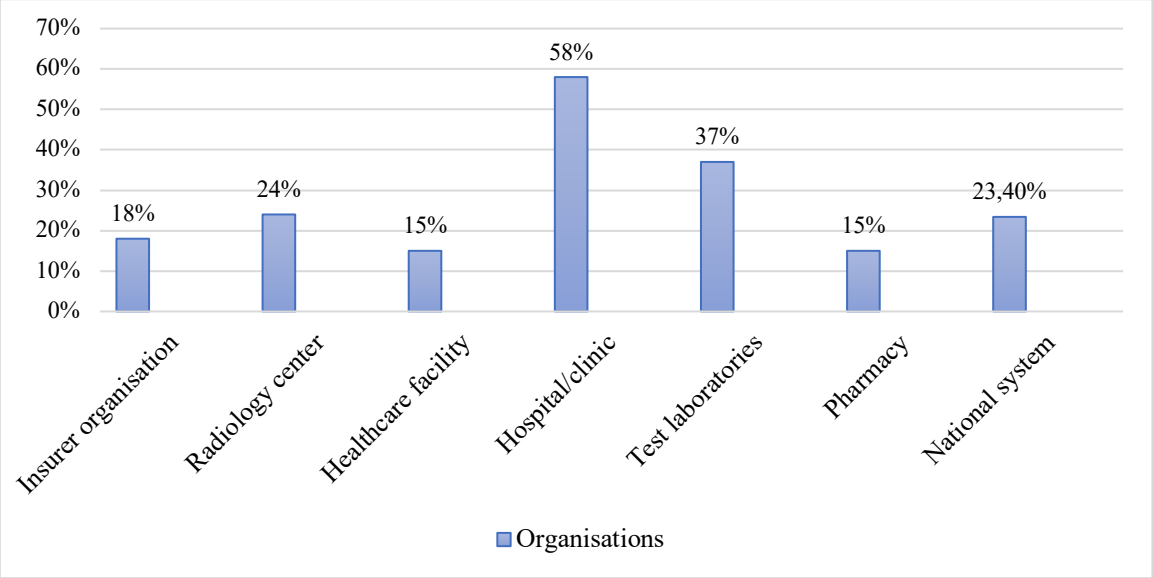


Fig.3.9 Health care organizations that use EHRs.

Replacing paper prescriptions with electronic ones is one of the main tasks of Morocco's e-healthcare system. Digital prescription is included in the government's health care plan for 2022 and for the beginning of 2024 is the experience of working in three departments [29].

The e-prescription consists of dematerializing the prescription process between the prescribers and the health professionals responsible for executing them. Its rollout began in 2022 with doctors and city pharmacies, particularly for prescriptions for health products.

Health insurance organizations currently use more than a billion prescriptions a year, but the number of paper prescriptions will decrease in the near future in favor of a digital prescription that facilitates sharing between doctors and pharmacists regarding the treatment provided to the patient.

The electronic prescription is one of the key measures of the "transformation" component digital" of the "Health 2022" plan, the road map of which was presented by government in April 2019. With the support of the National Health Insurance Fund, the e-prescription aimed to by 2022, to enter the field of medicine, biology, nursing and health care facility, all doctors and paramedics of the region. To implement this complex project, preference was given to pilot projects, gradually avoiding the disappearance of paper prescriptions [29].

It was also decided to start with community medicine, which concentrates about 500 million recipes per year, or half of the total. Since the end of 2017, Health Insurance has been experimenting in three departments (Val-de-Marne, Maine-et-Loire, Saône-et-Loire) the partial dematerialization of the prescription process. This first step towards e-prescription involved around sixty doctors general practitioners and around forty pharmacists, according to an assessment of the experimentation of March 2019 [29,55].

In this experimental setting, the doctor always gives the patient a paper prescription paper contains a QR code which will allow the pharmacist to consult the prescription written from their prescription assistance software, with the difference that the doctor's dematerialized prescription.

The first evaluation of this experiment in March 2019 showed that almost 25,000 e-prescriptions were submitted to Cnam out of 2,500 e-prescriptions submitted each month. Since July 2019, a second experiment carried out in the same three departments concerns the evolution of the system that will constitute the final solution with a database centralizing digital prescriptions. In mid-January 2020, there were about a hundred experimenters and more than 70,000 registered recipes (fig.4.0) [3,55].

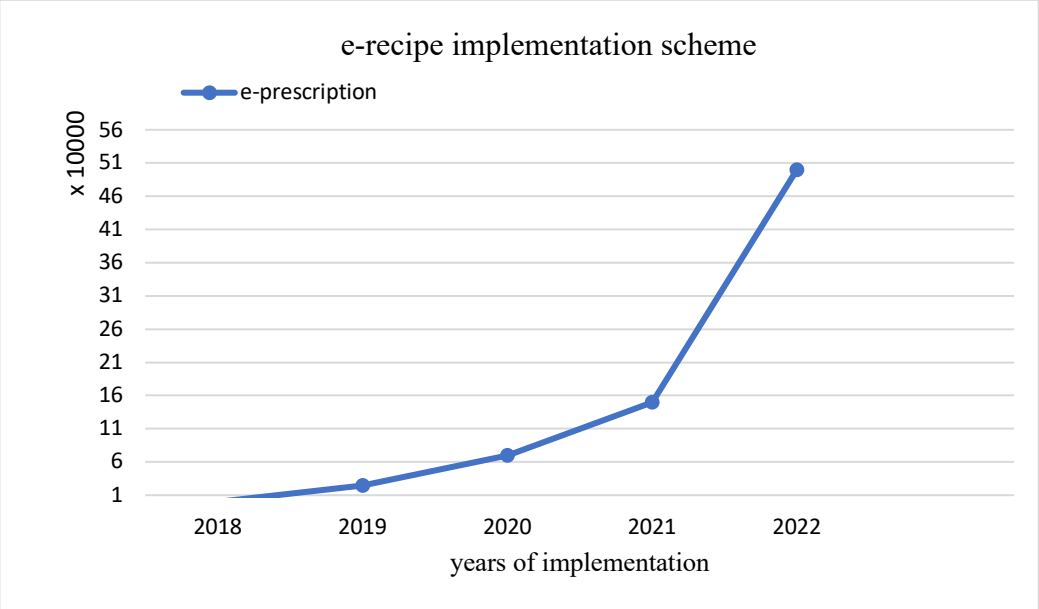


Fig.4.0 E-recipe implementation scheme.

States plan that electronic prescribing will ultimately provide the following benefits:

– achieving savings on paper and treatment of care sheets;

– security and traceability of health data to avoid attempts to falsification;

– elimination of risks of error in reading the prescription delivery of medicines in the event of loss of the prescription by the patient;

– highlighting of possible contraindications linked to other medications remote consultation or downloading by the patient of their prescriptions which have been prescribed by other doctors and appear in the database;

– better coordination of care and reliability of prescriptions.

This “core” service is part of the measures in the “digital transformation” section of the plan Health 2022, the roadmap of which was presented by the government in April 2019.

It is deployed gradually according to the following fig.4.1 [3,30,55].

Stages of e-prescription implementation	**2019**: experimentation with e-prescription of medicines in the city
	2020: start of generalization in cities and health establishments and experiments with e-prescription of biology and nursing procedures
	2021: experimentation with physiotherapy procedures and start of generalization to biology and nursing procedures
	2022: start of generalization to all medical assistants

Fig.4.1 Stages of e-prescription implementation.

The doctor, with the will be recorded in his SMF (shared medical file) electronic prescription, will know the medications that the pharmacist has dispensed to his patient.

Conclusions to the III Chapter

According to the analyzed reports and taking into account the unique characteristics of the healthcare system in Morocco, it can be argued that the Moroccan government is adopting an intermediate approach to implementing e-health. This approach seems to be more suitable for setting up a national EHR system compared to other approaches that show significant difficulties, although they have been applied in most countries around the world.

Morocco's health system faces challenges such as inequality in resources, inadequate funding and noncommunicable diseases. However, advances such as universal health coverage and improvements in health outcomes show progress. Addressing resource inequalities, increasing funding and the workforce, tackling noncommunicable diseases, adopting digital technologies and focusing on prevention are critical to improving the system.

E-prescription aims to make paper prescriptions disappear by securing its delivery circuit transmission from prescription by the doctor to dispensation by the pharmacist.

GENERAL CONCLUSION

1. After analyzing the studied sources, it can be concluded that electronic health care provides vital strategic support in the organization of health care procedures. This enables it to respond to the many challenges facing the system: the rise of chronic diseases, demographic changes, economic challenges and emerging health and social challenges.

2. The main characteristics of eHealth are its potential to be a catalyst for change and its ability to democratize understanding and access to information. It due to the fact that eHealth responds to the challenges of new and existing health care models.

3. The results of our research led to the conclusion that further problems related to eHealth worldwide is that the tools and services based on it are often designed for people who already have good opportunities to connect to Internet and have digital literacy.

4. It is established that the main challenges of e-health include: finance, ethics, digital literacy, trust, understanding of benefits. One way to address the challenges of eHealth is to provide information and education about what eHealth means and what its practical benefits are for patients and staff, and to ensure that the user and the system share the same goals.

5. The experience of the developed countries of the world shows that bringing order in the field of electronic prescriptions requires significant efforts, material costs, and a long time, therefore a transitional period is needed before the revision of legislative and regulatory acts regulating this process and their implementation by all links of the health care system. I.

6. In Morocco, a legal framework has been created to regulate e-health, which allows doctors to practice e-medicine as a full-fledged medical activity, the costs of which can be compensated by social security organizations. In recent years, the Moroccan government has invested heavily in telemedicine and eHealth innovation and experimentation in all 12 regions. Such investments

will improve access and equity of health care at a lower cost and provide better treatment with increased comfort and safety for the patient.

7. Despite efforts to implement eHealth in Morocco, the level of adoption and use remains relatively low, and this requires an assessment of the factors affecting effective implementation.

8. The main priorities of Morocco's electronic health care for specialists are the patient's electronic card (85%); training of doctors (e-learning) and telemedicine equal to 52%; the implementation of specialized clinical solutions takes 25%, and electronic prescriptions are used at the level of 35%.

9. Healthcare employees exchange data on patients' health with private clinics (58%) and testing laboratories (37%), electronic exchanges with pharmaceutical organizations remain low (15%).

10. Morocco's digital transformation was presented in the health 2022 plan, the roadmap of which the government began implementing in April 2019. The main stages of e-prescription implementation include four years.

11. The development and implementation of electronic prescriptions made an important contribution to the global reduction of medication errors and reduced the number of side effects on the body. To improve public health, it is important to be confident about access to medicines, the effectiveness, quality and safety of medicines, and the management of medicines standardized for the purposes of national medicines policy.

12. The deployment of e-health should pay more attention to the human resources of the health care system and provide appropriate specialized training to support and adapt to rapid technological progress to contribute to the improvement and popularization of the provision of medical and pharmaceutical care.

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