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DIGITAL HEALTH APPLICATIONS AND THEIR ROLE IN IMPROVING THE QUALITY OF HEALTH CARE SERVICES STUDY THE EXPERIENCE OF SAUDI ARABIA

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بسم الله الرحمن الرحيم
١٤٣٨

Dedication

To the most beautiful souls in my life

Mother
Your unwavering support, endless sacrifices, and boundless love have been the foundation of my success. Your faith in me has been my guiding light, and your strength has been my pillar. I owe everything to you, and words cannot express my gratitude.

Grandparents
Your wisdom, encouragement, and unconditional love have shaped who I am. The lessons you've imparted and the warmth you've provided are treasures I carry in my heart every day. You have been my inspiration and my refuge.

Sister
You are a beacon of light and love in my life. Your strength, compassion, and unwavering support have been my greatest gifts. Our bond is unique and irreplaceable, I treasure every moment we share.

Besties
Your friendship has been a sanctuary of strength, joy, and laughter. You've stood by me through every challenge and celebrated every triumph with me. I am blessed to have friends who feel like family.

My Precious Family
Your love has been my guiding light, illuminating every step of this journey. Each of you has played an integral role shaping me into the person I am today.

Thank you all for being my rock and my inspiration. This achievement is as much yours as it is mine. I am forever grateful for your love, support, and unwavering belief in me.

With all my love and gratitude

Tasnime

Dedication

To the dear one whose name I proudly bear, to my first ever teacher, the man who strived all his life for us to be the best; my father.

To the one who was the first and the biggest supporter of realizing my ambition, to the one who was my refuge and my right hand; my mother.

To my idol in this life, god have mercy on his soul; my uncle “Benhamadi Moussa”

To those whose love surpasses all other loves the ones who have been my support and strength on this journey; haythem and Yahia.

To the most innocent girl, your unconditional love, smiles and hugs have been a delightful reminder of what truly matters; Maya.

To the one who brings warmth to every moment, laughter to every gathering, and love to every heart; Chaima.

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To the ones whose laughter lit up the darkest days and whose encouragement fuelled my dreams, thank you for being the truest of friends; Sherine, Nour, Imen and Sirine.

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Abstract

This study aimed to identify the role played by digital health applications in improving the quality of healthcare services in the Kingdom of Saudi Arabia. To answer the question, the descriptive and analytical method is used, and by relying on books, reports, foreign articles, statistics on official websites and other references, we were able to collect and analyze information and data according to the requirements of the study.

This study came up with several findings, the most important of which is that digital health applications can improve the patient experience, especially in terms of access to health informations, making communication between doctor and patient more convenient, as well as their ability to change the way health care is delivered, leading to better outcomes for patients and increasing the efficiency of the system. Not to mention the role it plays in giving general indicators of health, both for the user and for healthcare stakeholders.

Digital health applications via smartphones in Saudi Arabia have contributed to enhancing health communication, disseminating adequate medical information and spreading health awareness. Thanks to digital transformation in health institutions, e-businesses represented by electronic systems, programs and applications such as Wasfaty, Mawid, Rasd, Sehha, e-Medicine, etc. have enabled the Kingdom to raise the level of readiness of its health institutions, increase the efficiency and quality of health services, and increase the satisfaction of beneficiaries.

Key words: digitization, digital health, health care services, quality, electronic programs and applications, Saudi Arabia, smartphones.

الملخص:

هدفت هذه الدراسة إلى معرفة الدور الذي لعبته تطبيقات الصحة الرقمية في تحسين جودة خدمات الرعاية الصحية في المملكة العربية السعودية. وللإجابة عن التساؤل والإشكالية المطروحة تم استخدام المنهج الوصفي التحليلي، وبالاعتماد على الكتب والتقارير والمقالات الأجنبية والإحصائيات على المواقع الإلكترونية الرسمية وغيرها من المراجع، تمكنا من جمع المعلومات والبيانات وتحليلها وفق متطلبات الدراسة.

وتوصلت هذه الدراسة إلى عدة نتائج، أهمها أن تطبيقات الصحة الرقمية يمكن أن تحسن تجربة المريض، خاصة فيما يتعلق بالوصول إلى المعلومات الصحية، مما يجعل التواصل بين الطبيب والمريض أكثر ملاءمة، وكذا قدرتها على تغيير طريقة تقديم الرعاية الصحية، مما يؤدي إلى نتائج أفضل للمرضى وزيادة كفاءة النظام. دون أن ننسى الدور الذي تلعبه في إعطاء المؤشرات العامة حول الصحة، سواء للمستخدم أو للجهات المعنية بالرعاية الصحية.

Abstract

وتطبيقات الصحة الرقمية عبر الهواتف الذكية في المملكة العربية السعودية ساهمت في تعزيز التواصل الصحي ونشر المعلومة الطبية الكافية ونشر الوعي الصحي، فبفضل التحول الرقمي في المؤسسات الصحية مكنت الأعمال الالكترونية متمثلة في الأنظمة والبرامج والتطبيقات الالكترونية كتطبيق وصفتي وموعد ورصد وصحة والمسعف الالكتروني...الخ، المملكة من رفع مستوى الجاهزية لمؤسساتها الصحية، ورفع كفاءة الخدمات الصحية وجودتها وزادت من رضا المستفيدين.

الكلمات المفتاحية: الرقمنة، الصحة الرقمية، خدمات الرعاية الصحية، الجودة، تطبيقات الصحة الرقمية، المملكة العربية السعودية.

Table of Contents

TITLES	Page
Dedication	/
Acknowledgments	/
Abstract	I
Tables of Contents	III
List of Figures	V
List of Tables	IV
Introduction	1
Chapter 1: background	
Axe 1: Concept of digital health	6
1.1 Definition of digital health	6
1.1.1 Importance of digital health	7
1.1.2 Goals of digital health	7
1.2 Challenges of digital health	8
1.3 digital health applications	9
Axe 2: Concept of health care services	11
2.1 Definition of health care services	11
2.1.1 Importance of health care services	12
2.1.2 Goals of health care services	12
2.1.3 Types of health care services	13
2.2 Definition of the quality of health care services	16
2.2.1 Quality aspects of health care services	17
2.2.2 Factors affecting the quality of health care services	17
2.2.3 Ways to improve the quality of health care services	19
2.3 Digital health applications and their role in improving the quality of health care services	19
Axe 3 : Previous studies	21
3.1 Previous studies in foreign languages	21
3.2 Previous studies in Arabic	25
Conclusion	29
Chapter 2: The empirical study	
Axe 1: Diagnostics of the health care sector in Saudi Arabia	32
1.1 Evolution of the health system in Saudi Arabia	32
1.2 Health care indicators in Saudi Arabia	33

1.3 Challenges of health care services in Saudi Arabia	40
Axe 2: Digital health in Saudi Arabia	42
2.1 The reality of digitization in Saudi Arabia	42
2.2 Digital health indicators in Saudi Arabia	47
2.3 Digital health challenges in Saudi Arabia	52
2.4 Digital health in Algeria	53
Axe 3: Digital health applications	56
3.1 Wasfaty application	56
3.2 Sehha application	58
3.3 Rasd applications	60
Conclusion	63
References	67

List of Figures

N	THE TITLE	Page
1	A model of factors affecting the quality of health care services	**18**
2	Population growth and population age range	**34**
3	Distribution of Hospitals by sector	**35**
4	Rates of health resources per 10000 population	**37**
5	Average download speed of 5G networks, in 15 of the world's leading 5G deployment countries	**44**
6	Expanding the scope of providing health care services in Saudi Arabia because of Digital innovations in healthcare.	**48**
7	Invest in telehealth, digital health records and new data-driven technologies	**49**
8	Investing in artificial intelligence	**50**
9	Investments in different areas of AI application	**50**
10	Predictive analytics use	**51**

List of Tables

N	THE TITLE	Page
1	Previous studies	**21**
2	Previous studies in Arabic language	**25**
3	Evolution of the health system in Saudi Arabia	**32**
4	Demograpic indicators	**33**
5	Vital statistics	**34**
6	Health resources	**35**
7	Colleges of medicine, dentistry and pharmacy	**36**
8	Rates of health resources per 10000 population	**36**
9	Total health manpower in KSA	**38**
10	percentage of Saudi in health sectors	**38**
11	Public health	**39**
12	The progress of Saudi Arabia in the United Nations indicators of e-government development	**46**
13	The most important e-Health applications in Saudi Arabia	**56**

INTRODUCTION

Introduction

Health care emerged as an integrated concept with the development of human societies and the increasing need to maintain the health of individuals and combat diseases. Historically, healthcare relied on traditional experiences and local knowledge, yet with scientific and technological advances, healthcare services have become a mainstay in any society through a variety of activities that seek to meet the health needs of individuals throughout their various stages of life. Improving the quality of these services has become a major goal of modern health systems. Achieving this goal depends on enhancing the continuous training of health workers, adopting medical and technological innovations, and improving the management of health resources.

In today's era, digitization is one of the revolutionary phenomena that is completely transforming various aspects of life. By digitizing data and information, digitization has opened new doors for development, creativity and innovation in many fields, from business and education to health, entertainment and various services. Digitization has become a major focus in improving efficiency and enhancing productivity, saving time and effort and facilitating access to information.

Within this field, digital health stands out as one of the most important areas that have benefited greatly from the digitization process. It is a powerful tool to address modern health challenges, since it contributes to improving access to healthcare in remote areas, reducing healthcare costs, and improving the management of chronic diseases. As technology advances, the potential of digital health expands to include new areas such as personalized medicine, electronic health records, telemedicine, and medical data analytics. These shifts are helping to provide more accurate and faster healthcare, reduce medical errors, and improve overall health outcomes.

Algeria is among the countries that have adopted the digital health project, which is a national strategy to modernize the administration and health institutions, through the use of information and communication technologies (ICT) in the administration and the development of several strategies in this field, starting with the electronic patient file (DEM), as part of the project to digitize the sector.

To improve the quality of health care services in Algeria, we have taken the experience of Saudi Arabia in digital health, specifically the applications of the latter through smartphones, to benefit from it in this field,

Problem statement : the problem of research has centered on the following key question:

How can digital health via mobile applications in Saudi Arabia improve the quality of healthcare services?

In order to address and analyses this problem and to gain a clear understanding of it, the following questions have been asked:

- What is digital health and digital health applications?
- What is meant by healthcare services?

- How have digital health applications via smartphones in Saudi Arabia contributed to improving the quality of healthcare services?

Hypotheses:

The following hypotheses have been formulated to answer previous questions and also to answer the study's problem

- Digital health refers to the use of information and communication technologies to manage and deliver health care services.
- Digital health applications are specific software tools and platforms within this broader field.
- Health care services are the organized provision of medical care to individuals or communities, including prevention, diagnosis, treatment, and management of illness and injury.
- Digital health applications via smartphones like "Sehha" and "Rasd" in the Kingdom of Saudi Arabia, have contributed to enhancing the quality of healthcare by improving access to medical services, simplifying appointment scheduling, and enabling remote patient monitoring.

Research methodology

To answer the questions asked and verify the hypotheses, this study relies on the descriptive and analytical approach in the two chapters. The descriptive approach lists theoretical facts, and the analytical approach is based on studying the case by analyzing and interpreting indicators and statistics found in books, articles, and reports.

Limitations of study

- **Spatial limits:** The kingdom of Saudi Arabia
- **Objective limits:** Digital health has many tools and applications, the research focuses on digital health applications via smartphones.
- **Temporal limits:** we started working on the second chapter from the beginning of March 2024 until mid-May of the same year.

Importance of the study

The importance of the study lies in the following

- Getting acquainted with the theoretical literature on digital health as well as health care services;
- Identify the importance role, and how to benefit from digital health applications to improve the quality of health care services in Algeria.
- The contribution of digital health to increasing technological awareness among individuals, especially patients.

Aims of the study

This study has several aims, including:

- Understanding the key theoretical concepts related to digital health, healthcare service quality, and digital health applications...
- Attempting to understand the pivotal role that digital health applications have played and will continue to play in improving healthcare services.
- Knowing and spreading the importance of adopting and using the digital health applications in the Algerian health sector.

Structure of the study

To address the primary research issue and evaluate the study's hypotheses, the work was organized into two chapters: a theoretical chapter and a practical one. Three main areas were covered in the first chapter: digital health, healthcare services, and previous research conducted in both Arabic and English.

The Kingdom of Saudi Arabia was the subject of a case study in the second chapter, wherein we examined the diagnosis of the country's healthcare system from the first axe, the second one was about digital health in the Kingdom of Saudi Arabia and some of its applications were covered in the final axe .

CHAPTER 1

BACKGROUND

Preface

In recent years, the field of healthcare has witnessed a significant transformation due to the rapid advancement and integration of digital technologies. Digital health applications have emerged as powerful tools that enhance the quality, accessibility, and efficiency of healthcare services. In this chapter we have dealt with the basics of degital health and its applications and the health care services represented in:

Chapter 01: background

Axe 1: concept of digital health

1.1 Definition of digital health
1.1.1 Importance of Digital Health
1.1.2 Goals of digital health
1.2 Challenges of digital health
1.3 Digital health applications

Axe 2: Concept of health care services

2.1 Definition of health care services
2.1.1 Importance of health care services
2.1.2 Goals of health care services
2.1.3 Types of health care services
2.2 Definition of the quality of health care service
2.2.1 Quality aspects of Health care services
2.2.2 Factors affecting the quality of health care services
2.2.3 Ways to improve the quality of health care services
2.2.4 Dimensions of the quality of health care services
2.3 Digital health applications and their role in improving the quality of health care services

Axe 3 : Previous studies

3.1 Previous studies
3.2 Previous studies in Arabic

Axe 1: concept of digital health

In this Axe, we will talk about digital health, its importance, its goals, its most important tools and applications, and the challenges it faces in general, which we have divided as follows:

1.1 Definition of digital health

The term "digital health" or "digital healthcare" refers to a broad, multidisciplinary concept that includes concepts from the intersection of technology and healthcare.

Digital health applies digital transformation to the healthcare sector, including software, technology, and services. digital health encompasses telehealth and telemedicine, wearable technology, electronic health records (EHRs), electronic medical records (EMRs), mobile health (mHealth) apps, and personalized medicine[1].

Digital health encompasses the use of telecommunication technologies, wearable, artificial intelligence, and machine learning to collect, share, and manipulate health information for improving patient health and healthcare services[2]. It includes a wide range of technologies such as telemedicine, electronic health records, wearable devices, mobile health applications, and digital diagnostics, which have shown great potential in revolutionizing clinical approaches and improving health outcomes[3].The digitization of medical data, like electronic health records, forms the foundation of digital health, facilitating the storage and management of patient information in a digital format [4].

The World health Organization (WHO) defines digital health in its digital health Strategy (2020-2025) as the use of digital technologies and data to enhance health outcomes, improve health system performance, and empower individuals to make informed decisions about their health and well-being. It also emphasizes the principles of transparency, accessibility, scalability, replicability, interoperability, privacy, security, and confidentiality. The scope of digital health is expanding rapidly and includes mobile health applications, wearables, telemedicine, electronic health records, health information systems, and artificial intelligence. These technologies are life-saving[5].

[1] https://www.carecloud.com/continuum/digital-health-importance-and-benefits/ , consulted on 01/04/2024, 12:00.
[2] Tchapmi, D. P., Agyingi, C., Egbe, A., Marcus, G. M., & Noubiap, J. J, The use of digital health in heart rhythm care, Expert review of cardiovascular therapy, vol(21), Iss(8), 2023, pp(553-563).
[3] Barracca, A., Ledda, S., Mancosu, G., Pintore, G., Quintaliani, G., Ronco, C., & Kashani, K. B, Digital health: a new frontier. Journal of Translational Critical Care Medicine, vol(5), Iss(2), 2023, p18.
[4] Desai, A., & Karous, G, Digital health. In Medical Innovation, CRC Press, 1st edition, united states, 2023, pp (121-129).
[5] https://www.wipo.int/policy/ar/news/global_health/2023/news_0011.html, consulted on 01/04/2024, 15:00.

1.1.2 Importance of digital health

The importance of digital health summarized in Communication between systems and devices is possible . Patients and medical professionals can better understand each person's health status by safely transferring data between platforms. The tremendous transformation that will take healthcare to the next level will be led by cloud-based digital health solutions that exchange data. By enabling people to track their health and giving doctors easy access to patient data, digital health is predicted to stop the rising rates of various diseases[1].

Also digital health plays a crucial role in modern healthcare by integrating technology to enhance patient care, communication, and overall well-being. It enables the shift from reactive to preventative healthcare[2], providing valuable health information through e-health interventions like telehealth, mobile health, and artificial intelligence[3]. Moreover, digital well-being emphasizes the impact of technology on mental, physical, and social health, highlighting the need for digital detox interventions and healthy digital habits[4]. The concept of digital health encompasses various technologies such as electronic health records, telemedicine, and wearable devices, aiding in disease diagnosis, monitoring, and prevention. However, it is essential to understand and manage the potential risks associated with digital health, including cyber threats, privacy issues, and medical misinformation[5].

Overall, embracing digital health is vital for achieving integrated care, improving patient outcomes, and addressing the evolving healthcare landscape.

1.1.3 Goals of digital health:

Digital health focuses on healthcare in the digital world, bridging the evolution of advances in informatics and technology in medicine, health and all aspects of health care with the application of these developments in clinical practice, the patient experience, and their social, political and economic implications.

Digital health covers themes including, but not limited to e-Health, healthcare IT, health informatics, biomedical engineering, connected health, internet health care, social media and online social networks, telemedicine, telehealth, telecare, medical imaging, mobile health, mobile technologies, wearable devices, genomics and personal genetic information, personalised medicine, Big Data and data management,

[1] https://www.carecloud.com/continuum/digital-health-importance-and-benefits/ , consulted on 02/04/2024, 08:00.
[2] Shah, B, Allen, J. L. Y, Chaudhury, H, O'Shaughnessy, J., & Tyrrell, C. S, The role of digital health in the future of integrated care. Clinics in Integrated Care, vol(15), 2022, p 15.
[3] Hemavathi, B, Bahraini, D, & Latha, A. S, Importance of E-Health in Human Life. In Big Data Analytics and Artificial Intelligence in the Healthcare Industry, IGI Global, 1st edition, united states, 2022, pp (262-275).
[4] Bora, S, & Neelakandan, R, Digital Well-being, International journal of research in education humanities and commerce, vol(4), Iss(2), 2023.
[5] Buchner, B, Digital Health, Datenschutz und Datensicherheit-DuD, vol(46), Iss(12), 2022, pp (729-729).

wellness and prevention, gerontology and social care services, simulation and gasification, patient accessibility, acceptability and behaviour, policy and regulation, and the social, political, cultural and ethical implications of advances in the field.

The primary aim of digital health is to provide universally accessible and digestible content to all stakeholders involved in the digital healthcare revolution. It provides a unique forum for dissemination of high quality content applicable to researchers, clinicians and allied health practitioners, patients, social scientists, industry and government[1].

Digital health goals also include:

- Digital health encompass enhancing healthcare efficiency, effectiveness, user-friendliness, and equity;
- Digital health aims to improve healthcare outcomes, patient experiences, population health, and healthcare costs, aligning with the quadruple aim[2].
- Digital health seeks to address public health challenges by leveraging artificial intelligence (AI) and other technologies to empower patients, improve care management procedures, and increase patient satisfaction[3]
- Digital health initiatives focus on providing patient-centered healthcare, informing, communicating, and motivating patients, while ensuring safety, quality, end-user experience, and equity in healthcare[4].
- The primary objectives of digital health are to revolutionize healthcare delivery, bridge gaps in healthcare access, and promote better health outcomes through innovative technological solutions[5].

1.2 Challenges of digital health:

Digital health is an exciting and fast-growing field, but it isn't without its challenges. As technology advances and more healthcare organisations move to digital solutions, several obstacles must be overcome to ensure digital health solutions are practical and secure.

[1] https://journals.sagepub.com/aims-scope/dhj, consulted on 02/04/2024, 20:00.
[2] Jacennik, B, on digital health research priorities: From telemedicine to telehealth, International Healthcare Review (Online), vol(1), Iss((1), 2022.
[3] Kim, H. S, Kwon, I. H, & Cha, W. C, Future and development direction of digital healthcare, Healthcare Informatics Research, vol(27), Iss((2), 2022, p 95.
[4] Khan, N., & Dave, S, Digital health: A silver bullet to make healthcare accessible for hard-to-reach populations. Indian Journal of Social Psychiatry, vol(38), Iss(2), 2022, pp (103-107).
[5] Arun Pulikkottil, Jose, Devraj Jindal, Dorairaj Prabhakaran, 14 Digital Health and Cardiovascular Disease Current Status and Future Directions, CRC Press, 1st edition, 2022, p(8).

- **Data and privacy:** One of the biggest challenges in digital health is data security and privacy. Previous years saw some of the most significant cybersecurity breaches in healthcare history, with over 22.6 million patients affected by healthcare-related data breaches in 2021. These attacks involve stealing patient data, preventing access to management systems or even affecting life-preserving equipment. As healthcare organisations move to digital solutions, they need to ensure the data they store and transmit is secure. This means ensuring the data is encrypted, access is restricted to authorised personnel and all access is logged. It's also critical to ensure that all data is stored in compliance with local and international regulations.
- **Ease of use:** Another challenge facing the healthcare industry is ensuring technology's easy to use. Digital health solutions must be user-friendly to be effective, providing the user interface is intuitive, the user experience is positive and the system is easy to use. It's also important to ensure that users are properly trained to be comfortable using the system. Demonstrating the quick adoption of this technology, 90% of NHS Trusts are expected to have an electronic patient record (EPR) in place by the end 2024. While millions of dollars are being spent on this new infrastructure, there's little in the way of training or time to get used to the new system, which can massively impact patient safety, time spent with patients, data quality and governance;
- **Scalability:** As more trusts adopt this new technology, it's become clear that digital health solutions must be scalable and robust. As healthcare organisations move to digital solutions, they need to ensure the solutions can handle an increase in data and users, are reliable and resilient and can adapt to changing requirements
- **Evolving patient's needs:** Investing in improving hospital patient experience isn't new it's been a priority for many years. Providing a positive patient experience has proven to impact healthcare outcomes, create efficiencies, preserve resources, limit healthcare service utilisation and ease workloads. Some of the most common frustrations faced by NHS staff and patients can be relieved by investing in modern improvements that can make a real difference. When bedside units were first installed, they were a great way to keep hospitalised patients entertained. 20 years later, time has reduced the quality of this useful resource which makes them less optimal for the patient than before. Investing in more up-to-date bedside technology solutions can massively improve the hospital and patient experience[1].

1.3 Digital health applications:

There are a lot of definitions of Digital health applications such as:

[1] https://thejournalofmhealth.com/what-are-currently-the-biggest-challenges-in-digital-health/ , consulted on 03/04/2024, 08:00.

Digital health applications refer to software programs or platforms that utilize digital technologies to enhance healthcare delivery and improve patient outcomes. These applications play a crucial role in connecting patients with healthcare providers, analyzing patient data, and facilitating remote access to healthcare services. They encompass a wide range of tools such as wearable technologies, tele-medicine, mobile health apps, and virtual reality technologies[1].

Digital health applications provide continuous patient-medical staff connection and automated data analysis. They rely on modern wireless networks for secure, real-time data transmission and storage[2].

Digital health applications are tools that utilize digital technologies to enhance healthcare outcomes. They play a crucial role in reducing healthcare emissions and addressing climate change impacts on health[3].

Digital health applications include telemedicine, electronic health records, wearable devices, AI algorithms, and mobile health apps, aiming to revolutionize healthcare through data science and technology[4].

Digital health applications encompass digital color-coded systems, mobile technology for health declarations, and epidemiological data collection via handheld devices, enhancing public health surveillance and decision-making processes[5].

Digital health applications (DiHAs) can be defined as digital medical devices that can support the treatment of illnesses or the compensation of impairments. In addition to smartphone applications, they can include browser-based web applications or software for use on classic desktop computers . The main function of the DiHA is based on digital technologies that support the detection, monitoring, treatment, compensation or mitigation of disease, injury or disability . DiHAs can be seen as a component of electronic health (eHealth), with mobile devices (e.g., cell phones) monitoring, inter alia, vital signs of patients in a medical care context[6] .

[1] Eşiyok, A, Uslu Divanoğlu, S, & Çelik, R, Digitalization in Healthcare-Mobile Health (M-Health) Applications, Dspace@aksaray, vol(15), Iss(2), 2023.
[2] Ahmad, R., Hämäläinen, M., Wazirali, R., & Abu-Ain, T, Digital-care in next generation networks: Requirements and future directions, Computer Networks, vol(224), 2023.
[3] Lokmic-Tomkins, Z, Borda, A, & Humphrey, K, Designing digital health applications for climate change mitigation and adaptation, Medical Journal of Australia, vol(218), Iss(3), 2023, pp (106-110).
[4] Cordeiro, J. V, Digital technologies and data science as health enablers: an outline of appealing promises and compelling ethical, legal, and social challenges, Frontiers in medicine, vol(8), 2021, p(8).
[5] Cheong, I. H., & Wang, H, Applications of digital health in public health: the China experience. Innovations in Digital Health, Diagnostics, and Biomarkers, vol(2), (2022), pp (48-50).
[6] Gregor Goetz, Reinhard Jeindl, Dimitra Panteli, Reinhard Busse, Claudia Wild, Digital Health Applications (DiHA): Approaches to develop a reimbursement process for the statutory health insurance in Austria, Health Policy and Technology, vol(12), Iss(3), 2023.

Axe 2: concept of health care services:

In this Axe we will talk about health care services in general and which we devided as follows:

2.1 definitions of health care services:

The body responsible for providing health care services is the health institution, which is a social and human structure that aims to achieve specific goals that include inputs and outputs, and it consists of three basic elements, individuals and groups that need health services, individuals or professionals specialized in various health fields, and social and humanitarian organizations that organize a method providing the health service, the method of financing and purchasing services, regulating and legislating services, planning and coordinating, setting goals, and constantly striving to improve services and monitoring.

Health services are a form of service and one of the inputs to health production. It has been defined as "the treatment provided to the patient, whether it is personal, counselling, or medical intervention, which results in patients' satisfaction and benefit.

Health care services are defined as "all activities directed to maintain human health and safety through the treatment and prevention of diseases. It was also defined as "all services provided by health institutions, whether treatment directed to the individual or preventive treatment directed to the community and the environment, or productivity such as medicines, medical preparations, medical devices and others, with the aim of raising the health level of individuals and satisfying the desires associated with this service[1].

It has also been defined as health service delivery is the provision of healthcare to the population, encompassing accessibility, quality, efficiency, transparency, accountability, equity, and professionalism within health facilities and communities[2].

It also includes health care services encompass measures to maintain and enhance physical and mental well-being, providing medical care and services to promote public health efficiently[3].

Through the set of definitions that we presented previously, we conclude that health care services are all the activities, functions, or tangible and intangible elements provided by health institutions of various types, whether affiliated with the public or private sector, and may be directed to the individual or to society as a whole, with the aim of improving health through prevention. Diagnosis, rehabilitation and treatment of diseases.

[1] Serai Oumessaad, Hadjab Nadjat, Digital transformation in health institutions and its role in improving the quality of health care services in light of the corona pandemic- the experience of the Kingdom of Saudi Arabia, Journal of Contemporary Economic Studies, vol(7), Iss(1), (2022), p (717).

[2] Kalolo, A., & Jiyenze, M. K, Health Service Delivery. In Leadership and Governance in Primary Healthcare, CRC Press, 1st edition, 2023, pp (27-41).

[3] Zakharii-Andrii, Feshchenko, Iryna, Yurchak, Service for Monitoring the Conditions of Vaccination of the Population from Coronavirus Infection, Advances in cyber-physical systems, vol(7), Iss(1), 2022.

2.1.1 Importance of health care services

Health services play a fundamental role because they are related to the life of the individual and society. It seeks to raise the quality of people's life and build a healthier society. Health care is provided through the health system, which includes all the organizations and institutions working in this sector and all the material and human resources affiliated with it[1].

The importance of health care services is evident in the following:

- Health service delivery is crucial as it reflects health system performance, meeting the population's healthcare needs. It is judged by accessibility, quality, efficiency, transparency, accountability, equity, and professionalism[2];
- Health services are crucial for disease prevention, recovery, and societal health improvement;
- Factors like personnel-patient interaction, trust, fees, facilities, and nutrition impact service satisfaction, reflecting quality and effectiveness[3];
- Health care services address physical and mental health needs, especially for women, children, and communities;
- High-quality health care helps prevent diseases and improve quality of life;
- Helping health care providers communicate more effectively can help improve health and well-being, and the Strategies to make sure health care providers are aware of treatment guidelines and recommended services are also key to improving health[4].

2.1.2 Goals of health care services

The goals of health care services are:

- The goals of health care services encompass broad aspirations for the future, reflecting the well-being of entire nations or societies, aiming to improve overall public health outcomes[5].
- The goal of health services is to achieve equal access and quality care for all, with priorities set through political acceptance and frameworks to allocate resources effectively[6].
- They also improve patient-centered health outcomes by identifying more effective or efficient approaches to healthcare organization, management, delivery, and financing[1].

[1] Serai Oumessaad, Hadjab Nadjat. Op.cit, (p 718).
[2] Kalolo, A., & Jiyenze, M. K., Health Service Delivery, op.cit, pp (35-41)
[3] Altan, F., Ekiyor, A, & Unalan, D, Health services delivery and satisfaction. Quality Management for Competitive Advantage in Global Markets, IGI Global, 1st edition, China, 2021, pp (95-108).
[4] https://health.gov/healthypeople/objectives-and-data/browse-objectives/health-care#:~:text=High%2Dquality%20health%20care%20helps,improve%20health%20and%20well%2Dbeing. , consulted on 22/04/2024, 12.00 pm.
[5] Vaupel, J. W., Carey, J. R., & Christensen, K, It's never too late. Science, vol(301), Iss(5640), 2023, pp (1679-1681).
[6] Ringard, Å, Mørland, B, & Larsen, B. I, Quality and priorities in the health services, Tidsskrift for Den norske legeforening, vol(132), 2021.

- Contribute to achieving the best services for patients in cooperation with the medical team in various specialties.
- Providing social and psychological support to patients and their families and solving their issues by utilizing local community resources.
- Working with long-stay patients and facilitating their discharge after obtaining all their needs for medical treatment and social intervention;
- Raising social awareness by providing guidance and counseling services to patients and their families.
- Conducting coordination programs and activities with the social service departments of the Ministry of Health to increase communication and provide the best services.
- Work to train university students seconded from universities and institutions and provides them with information about the role of the social researcher at the medical complex.
- Participating in local and international conferences, seminars and lectures[2].

The overarching goal of health care services is to maximize the potential benefits of digital health technologies by integrating them into healthcare practices and empowering both users and healthcare professionals

2.1.3 Types of health care services

There are many criteria by which health care services are categorized, due to their many forms on the one hand, and the diversity of health institutions providing these services on the other hand. Health services are categorized either by their nature, or by their orientation to personal or public health, or by their beneficiaries, or by the organization responsible for providing the health service.

1. **Classification based on the nature of health services:**

Health services are categorized according to this criterion[3]:

- **Examinations and consultations:** It is the motive of meeting and interaction between the service seeker and the service provider, as it is the front of the organization.
- **Clinical services:** Provides accommodation for patients, the workplace of people involved in medical care (medical diagnostics, nursing care) (medical diagnostics, nursing care), as well as people not involved in medical care (maintenance workers, cleaners), and in the place of interaction with families.

[1] Horner, R. D, Russ-Sellers, R, & Youkey, J. R, Rethinking health services research. Medical care, vol(51), Iss(12), 2013, pp (1031-1033).
[2] https://www.mrhb.gov.sa/cms/portal/TXdsdkV1bHVHMHdjYjRiSFkxOGt6UT09 , consulted on 12/05/2024, 22:59.
[3] Nadia Kharif: The impact of change management on the quality of services in the health organization - a case study of Bachir Ben Nasser Hospital in Biskra, PHD, Faculty of Economics and Management Sciences, Mohamed Kheder University of Biskra, Algeria, 2008, pp (67-68).

- **Technical floor:** It includes the technological means for diagnosis and treatment.
- **Supply services:** It consists of all services that support the previous activities such as restoration, maintenance and transportation, and this service may be carried out by a department within the institution or entrusted to an external party (service provider).
- **Administrative services:** It combines various administrative functions (planning, directing, organizing, controlling) and includes various financial and accounting departments and divisions, personnel management, inventory management.

2. Classification based on personal or public health orientation:

This is one of the most common classifications that categorizes health services into two types[1]:

2.1 Personal health services: It means preventive, therapeutic or rehabilitative services provided to the individual by the doctor or by those qualified for diagnosis, treatment and personal care, such as laboratory, radiology, nutrition, physiotherapy and nursing, as the patient's visit to the doctor or physiotherapist for treatment are two forms of personal health services, and health services include different types of services, which we summarize as follows:

- **Outpatient services:** These are health services that do not include residential care for beneficiaries, and this type of services are usually provided in private doctors' clinics or affiliated with the hospital's outpatient clinics, or in the emergency department attached to it, or in primary health care centers, as well as in medical treatment centers.
- **Hospital inpatient services:** These are residential or hospital health care services provided to patients whose health condition requires them to stay in general or specialized hospitals for diagnosis and treatment for periods not exceeding 30 days.
- **Long-term care services:** These are health services that combine the two types of care mentioned above, and the duration of accommodation often exceeds 30 days. Most of the beneficiaries of these services are persons with disabilities and chronic diseases. Examples of such services include mental health hospitals, health services provided in sanatoriums, convalescent homes, comprehensive residential care centers for the disabled and the elderly and nursing homes, as well as those services provided by home nursing care specialists for persons who need the care of others, especially the elderly, but whose health condition does not require them to stay in the hospital

2.2 Public health services: these are health services aimed at protecting and improving the health of citizens. The State usually assumes responsibility for providing these services, which primarily include the following activities:

[1] Talal bin Ayed Al-Ahmadi: Health Care Management, Institute of Public Administration, Riyadh, Saudi Arabia, 2004, pp (25-26).

- Combating infectious diseases, especially endemic ones.
- Monitoring important aspects of environmental health, such as air safety, adequate food, control of harmful insects and rodents, waste disposal and wastewater treatment.
- Directly supervising maternal and child care with a special focus on immunization programs.
- Conducting laboratory tests related to the field of public health.
- Educating and informing citizens about the prevailing health issues and ways to optimize the use of available health services.
- Developing legislation, regulations, controls, policies, strategies and plans that ensure the preservation of the health and well-being of citizens.

3. **Categorization based on who is responsible for providing the health service:** according to this standard, the health service is categorized into[1]:

- **Direct services:** These are services that are performed by the doctor himself, such as diagnosing and treating the disease.
- **Indirect services**: These are services performed by a non-physician member of the medical team and include nursing services, laboratory analysis services or radiology images. Medical record-keeping services and financial and administrative affairs related to the services.

4. **Classification based on the beneficiary of the service:** according to this criterion, health services are categorized into[2]:

- **Individual services:** that is, those services that benefit one person without any relationship with any specific entity, institution or medical system, such as a sick person going to a clinic and receiving medical treatment.
- **Group or organized services:** Those services that benefit a number of individuals belonging to a single institution or system according to specific procedures and rules, such as the services provided by companies and institutions to their workers and employees, whether by appointing a full-time doctor in that institution, or contracting with doctors and hospitals to treat the users of that institution according to a specific agreement. Governments and responsible authorities resort to organizing medical services in order to ensure that individuals receive a full medical service without financial strain. The various health insurance systems are a type of medical service organization designed to relieve the current burden on the individual who needs medical services.

[1] Abdul Majeed Al-Shaer, et al: Primary Health Care, Dar Al-Yazourdi, first edition, Amman, Jordan, 2000, pp (11-12).
[2] ibid, p.12.

2.2 Definition of the quality of health care services

Quality of care is the degree to which health services for individuals and populations increase the likelihood of desired health outcomes. It is based on evidence-based professional knowledge and is critical for achieving universal health coverage. As countries commit to achieving Health for All, it is imperative to carefully consider the quality of care and health services. Quality health care can be defined in many ways but there is growing acknowledgement that quality health services should be[1]:

- **Effective**: providing evidence-based healthcare services to those who need them.
- **Safe**: avoiding harm to people for whom the care is intended; and
- **People-centred**: providing care that responds to individual preferences, needs and values.

To realize the benefits of quality health care, health services must be:

- **Timely**: reducing waiting times and sometimes harmful delays.
- **Equitable**: providing care that does not vary in quality on account of gender, ethnicity, geographic location, and socio-economic status.
- **Integrated**: providing care that makes available the full range of health services throughout the life course.
- **Efficient**: maximizing the benefit of available resources and avoiding waste.

The quality of health care is also defined as the major of how well Healthcare services work to provide a positive or desired outcome for patients. Quality of health care is based on utilizing evidence-based and regard for patient needs and safety in order to insure that patients are being given the highest level of treatment. While quality of care is not strictly codified by a set of explicit rules. It is based on guidelines and components that can be adjusted to any health system in the world. Since the availability of healthcare resources varies from country to country, quality of care helps to ensure that people all over the world are provided with the best healthcare possible[2].

The quality of health care services is crucial for patient satisfaction and involves various dimensions such as reliability, assurance, tangible aspects, empathy, responsiveness.

[1] https://www.who.int/health-topics/quality-of-care#tab=tab_1 , consulted on 28/04/2024, 11:43
[2] https://study.com/academy/lesson/quality-care-definition-importance-examples.html , consulted on 28/04/2024, 13:03

Health care quality management is essential, encompassing accessibility, appropriateness, affordability, effectiveness, safety, and patient-centered care[1]. Achieving patient satisfaction through quality health services is a primary goal, emphasizing the importance of continuous improvement and outcome-driven systems[2].

2.2.1 Quality aspects of health care services

The aspects of the quality of health care services include infrastructure, reliability, responsiveness, empathy, affordability, and administration [3].These aspects are crucial in shaping the care experience beyond just technical competence. Patient satisfaction is closely linked to these factors, with studies showing a positive relationship between embodiment, reliability, reassurance, responsiveness, and empathy for patient satisfaction [4]. Additionally, patient satisfaction is a key parameter for measuring the level of healthcare service quality, emphasizing the importance of factors such as physical environment, staff behaviour, and affordable services in ensuring superior quality of healthcare services to patients . Quality management in healthcare involves thorough and systematic checks, internal quality assurance programs, and external assessments based on standards like ISO 9001 to guarantee high-quality service delivery[5]

2.2.2 Factors affecting the quality of health care services

Quality in healthcare is a production of cooperation between the patient and the healthcare provider in a supportive environment. Healthcare service quality depends on personal factors of the healthcare service provider and the patient and factors pertaining to the healthcare organisation and broader environment. Differences in internal and external factors such as availability of resources and collaboration and cooperation among providers affect the quality of care and patient outcomes. A number of theoretical relationships can be inductively inferred from the preceding analysis. These relationships are depicted in Figure 1[6]

[1] Naif, Hezam, Fahad, Alruways., Geza, Abdulah, AlAlwey., Ahmad, Rayan, Alfuraydi., Suliman, Ali, Alhussain., Nasser, Ibrahim, Aleidi., Adel, Abdulah, Aldukhil., Mohammed, Nasser, algdairy., Talal, Saad, Almutoua., Moteb, Khaled, Aldhwyan., Satam, awed, al, harbi, The Future of Healthcare Quality and Safety, International journal of pharmaceutical and bio-medical science, vol(02), Iss(12), 2022, pp 646-651

[2] Noor, V. M. M., Tunjungsari, F., Nurdiana, H., & Fanani, M. A.), Analisis Tingkat Kepuasan Pasien Rawat Inap BPJS Terhadap Mutu Pelayanan Kesehatan Pada Rumah Sakit Tipe C. CoMPHI Journal: Community Medicine and Public Health of Indonesia Journal, vol(3), Iss(2), 2022, pp 39-45.

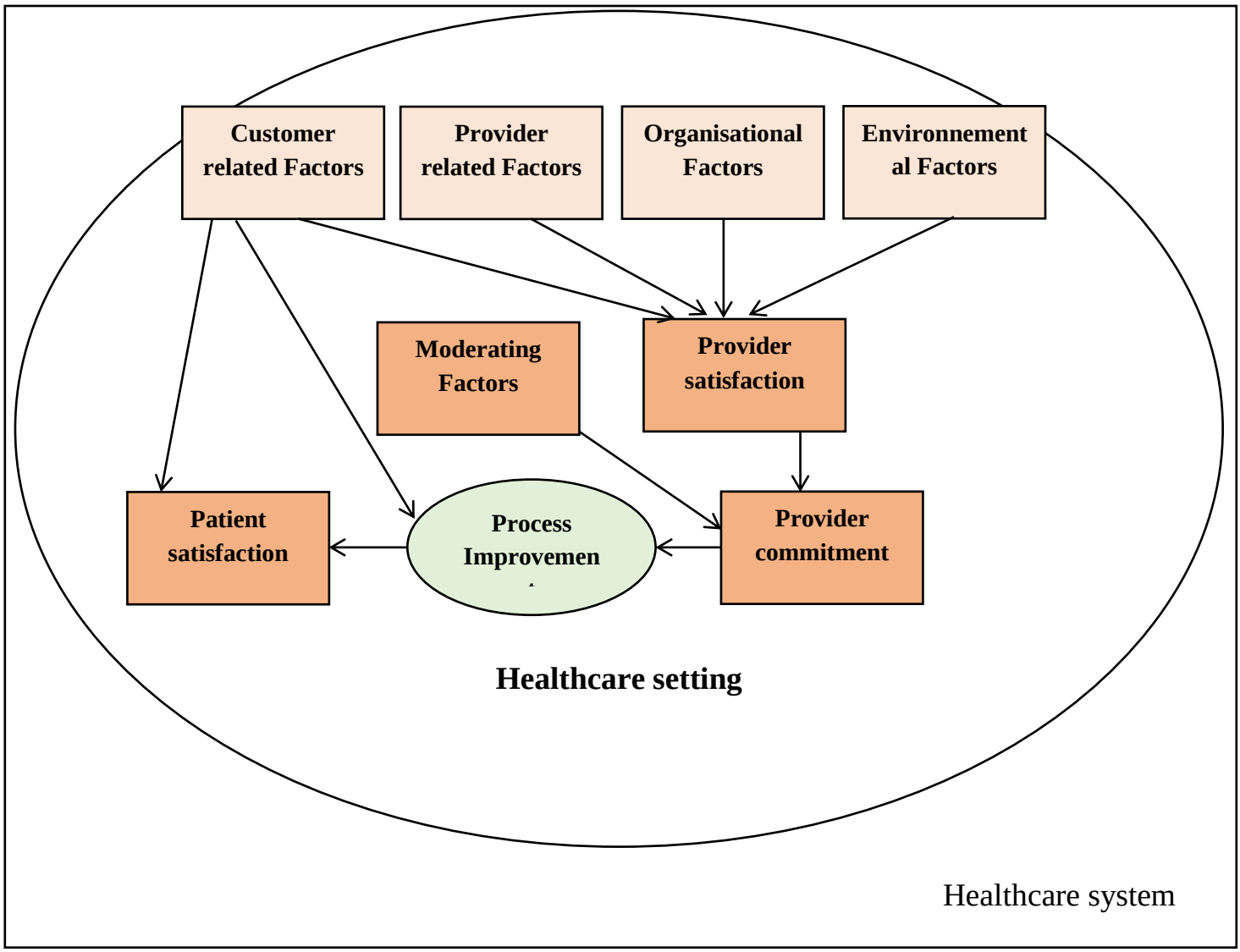
[3] Ghildiyal, A. K, Devrari, J. C, & Dhyani, A, Determinants of Service Quality in Healthcare: Patient and Provider Perspectives. International Journal of Patient-Centered Healthcare (IJPCH), vol(12), Iss(1), 2022, pp (1-12).

[4] Yunike, Y., Tyarini, I. A., Evie, S, Hasni, H., & Suswinarto, D. Y, Quality of health services to the level of patient satisfaction, Jurnal Ilmiah Kesehatan Sandi Husada, vol(12), Iss(1), 2023. pp (183-189).

[5] Ręba, P, Quality management in health care, Journal of Education, Health and Sport, 11(3), 2021, pp (11-15).

[6] Ali Mohammad Mosadeghrad, Factors influencing health care quality, International journal of health policy and management, vol(3), Iss(2), 2014, p(77).

Figure (01) : A model of factors affecting the quality of healthcare services



Source: Ali Mohammad Mosadeghrad, Factors influencing health care quality, International journal of health policy and management, 3(2), 2014, p77.

This model illustrates a variety of individual, organisational, and environmental factors that influence a caregiver's job satisfaction and consequently commitment in providing high-quality services. Individual factors include age, personality, education, abilities, and experience. Organisational factors include management style, working conditions, and relationships with co-workers. Environmental factors consist of economic and social influences. Furthermore, customer related factors such as socio-demographic variables, attitude, and cooperation influence the quality of care provided. The provider's subjective attributes, including the priority they give to care, would have a moderating influence on the delivery of care.

2.2.3 Ways to improve the quality of health care services

Improving the quality of healthcare services is essential for ensuring better patient outcomes and satisfaction. It involves enhancing accessibility, efficiency, safety, and effectiveness across all aspects of healthcare delivery. This can be achieved through advancements in technology, training and development of healthcare professionals, implementation of evidence-based practices, and fostering a culture of continuous improvement and patient-centered care[1].

- Increase Access to Care.
- Prioritize training and education
- Engage Patients and Families.
- Improve Communication.
- Measure and Monitor Quality.
- Set Tangible Goals.
- Set Tangible Goals.

2.2.4 Dimensions of the quality of healthcare services

There are several dimensions of health service quality[2]:

- **Responsiveness:** Responsiveness in health service quality includes the following elements: Speed, immediate response to the patient's needs and the constant readiness of the staff to cooperate with the patient and respond to their inquiries.
- **Dependability:** The extent to which the organization is able to deliver health services on time and with a high degree of accuracy and efficiency.
- **Safety:** It means that the management of the health institution emphasizes health quality and supports this with qualified personnel and the provision of modern material supplies.
- **Tangibility:** It includes physical facilities, the external appearance of the building, amenities and entertainment such as educational medical programs.
- **Empathy:** It means the presence of trust, respect, tact, kindness, courtesy, civility, confidentiality, understanding, listening and communication between health service providers and beneficiaries

2.3 Digital health applications and their role in improving the quality of health care services:

The healthcare Industry is rapidly progressing and its practices have changed compared to the last decade. The role of mobile apps in the healthcare industry is increasing as new healthcare technologies also progress daily.

[1] https://www.intelycare.com/facilities/resources/5-ways-to-improve-quality-of-care-at-your-facility/ , consulted on 29/04/2024, 22:00.
[2] Bua'ana Abdul Mahdi, Management of Health Services and Institutions, Al-Hamid House and Library, 1st edition, Jordan, 2004, p(100).

There is massive involvement of technology in mobile apps and smart hardware using IoT wearables or Robotics. Healthcare brands are now preferring to invest in a healthcare mobile app.

On the other side, patients also prefer mHealth practices, which stands for an individual who can access medicines and public health services through a mobile device via mobile applications. Healthcare mobile apps are helping to improve healthcare systems, and it is happening in real-time dimensions.

The mobile apps are helping patients get treatment or second opinion with ease and, on the other hand, assisting healthcare professionals in offering their services.

It includes booking appointments with doctors, ordering medicines, or purchasing healthcare supplements via a mobile app[1].

Also, the use of mobile health apps could improve patient experience, especially with regard to accessing health information, making physician-patient communication more convenient, ensuring transparency in medical charge, and ameliorating short-term outcomes. All of these may contribute to positive health outcomes. Therefore, we should encourage the adoption of mobile health apps in health care settings so as to improve patient experience[2].

[1] https://devtechnosys.ae/blog/role-of-mobile-apps-in-the-healthcare-industry/, 2023, consulted on 13/05/2024 , 11:22

[2] Chuntao Lu , Yinhuan Hu , Jinzhu Xie , Qiang Fu , Isabella Leigh , Samuel Governor , Guanping Wang , The Use of Mobile Health Applications to Improve Patient Experience: Cross-Sectional Study in Chinese Public Hospitals, JMIR Mhealth Uhealth, vol(6), Iss(5), 2018.

Axe 3: Previous studies

The previous studies were divided into Arab and foreign studies, and they will be presented on this basis, taking into account the order in the type of study and the date of publication, and the most important studies that we have seen are explained through the first and second requirements**.**

3.1: previous studies

In this requirement, some foreign studies have been addressed, which we summarize in the following table**:**

Table (01) : previous studies

Study of (Jimoh ayanda oladipo), 2014.	
Title	Utilization of health care services in rural and urban areas: A determinant factor in planning and managing health care delivery
Study type	Article, https://pubmed.ncbi.nlm.nih.gov/25320580/ .
Study community	health facilities
Sample size	1086 potential health services consumers**.**
Study goal	Determine the relative importance of the various predisposing, enabling, need and health services factors on utilization of health services; similarity between rural and urban areas; and major explanatory variables for utilization.
Study methods	A four-stage model of service utilization was constructed with 31 variables under appropriate model components. Data is collected using cross-sectional sample survey of 1086 potential health services consumers in selected health facilities and resident milieu via questionnaire. Data is analyzed using factor analysis and cross tabulation.
Study tools	Questionnaire
Main Results	The 4-stage model is validated for the aggregate data and data for the rural areas with 3-stage model for urban areas. The order of importance of the factors is need, enabling, predisposing and health services. 11 variables are found to be powerful predictors of utilization.
Points of differences	Both studies are quantitative, but their studies relied on questionnaire to collect data, and ours is analytical and relied on statistics

Points of Similarities	The study will benefit from expanding knowledge related to the theoretical aspect regarding the dependent variable, which is health care service**..**
Study benefits	The study will benefit from expanding knowledge related to the theoretical aspect regarding the dependent variable, which is health care service**.**

Study of (Andrian Liem, PhD, Rifani B. Natari, Jimmy, MIS, PhD(c),and Brian J. Hall, PhD), 02 /01/2021	
Title	Digital health applications in mental health care for immigrants and refugees: a rapid review
Study type	Article https://www.liebertpub.com/doi/abs/10.1089/tmj.2020.0012
Study community	Immigrants, refugees, asylum seekers(from around the world).
Sample size	/
Study goal	To explore and summarize the existing digital health applications in mental health care (MHC) for immigrants and refugees and its outcomes; how the ethical standards of digital health applications in MHC are implemented and reported; and the challenges for scaling up digital health applications in MHC for immigrants and refugees.
Study methods	Descriptive Analytical Approach
Study tools	General Survey Tool
Main Results	A total of 16 studies were reviewed that applied software, website, and videoconferencing technologies. These applications were applied in various stages of MHC (screening, assessment, diagnosis, and intervention). Participants reported satisfaction and positive attitudes toward applications of digital health in MHC, and positive improvement on their anxiety, depression, and post-traumatic stress disorder symptoms. However, the ethical standards of these digital health applications were poorly implemented and reported. Stigma toward mental disorders and lack of technology literacy were the main challenges in scaling up digital health applications for immigrants and refugees.

Points of differences	This study was focused on digital health applications in mental healthcare, while our study was about the digital health applications in all healthcare services and in general.
Points of Similarities	Both of studies were about the sector of health and healthcare, digital health and its applications.
Study benefits	Benefiting from the theoretical aspect regarding the variables of the study, whether the dependent variable or the independent variable.

Study of (Gregor Goetz , Reinhard Jeindl , Dimitra Panteli , Reinhard Busse , Claudia Wild) , September 2023	
Title	Digital Health Applications (DiHA): Approaches to develop a reimbursement process for the statutory health insurance in Austria
Study type	Original article/Research https://www.sciencedirect.com/science/article/pii/S2211883723000564
Study community	Austrian people
Sample size	/
Study goal	To elaborate a concept for implementing digital health applications (DiHA), including prioritisation criteria (PC) for the Austrian context and an overview of available prioritised DiHAs.
Study methods	Experimental approach
Study tools	/
Main results	The meta-directory comprised 132 DiHAs. Developed PC focused on plausibility (Germanlanguage) and legal aspects (treatment/monitoring of chronic conditions), while other criteria (e.g. interoperability standards) were considered optional. After applying the PC, 38 DiHAs were potentially relevant in the Austrian setting. Of these, only seven supported current health record integration. Most of the prioritised DiHAs reported on CE marking (29/38) and data protection (35/38), while reporting on risk class (10/38) and technical algorithms (0/38) was sparse. For DiHA reimbursement, a four-step process is proposed: identification (ideally based on needs assessment); filtering based on PC; review of technical, regulatory and evidentiary requirements; and health technology assessment.

Points of differences	The study community were Austrian people while our study community were Saudi Arabia people ; This study talked about digital health applications to develop the legal health insurance payment process in Austria, but our study talked about digital health applications, specifically smart phone applications in health care services in the Kingdom of Saudi Arabia.
Points of Similarities	we both aim to prioritize this subject and make the digital health applications more accessible and usable in the health sector
Study benefits	Benefiting from the study in expanding knowledge related to the theoretical aspect, especially digital health applications

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3.2 previous studies in Arabic language

There are many Arabic studies that we have reviewed that are related to the variables of our study, and the following table shows some of them:

Table (02) : previous studies in Arabic language

Study of (Nesrine Samir ahmed fouad),2020.	
Title	Digital health applications and their role in improving the quality of life (Vezeeta Enzyme)
Study type	Article https://journals.ekb.eg/article_278209_03ed6fe9490e05083bf5e0bb2eeb279c.pdf
Study community	Egyptian people
Sample size	120 individuals from the users of the Vezeeta application
Study goal	This study aims to identify the role of the Vezeeta application as one of the digital health applications in improving the quality of life. Its development within the Egyptian society and its geographic surroundings, its vision, its goal, the services it provides, the legislation and texts that define the relationship within it between those in charge of it and health services users or between them and doctors.
Study methods	This study is descriptive and analytical ,by using the sample social survey method.
Study tools	Interview , questionnaire
Main results	-There are no downsides to Vezeeta as a digital health app. - The respondents' perception of the role of Vezeeta app in improving healthcare services and quality of life was to exclude doctors or health entities in the app that are misjudged by health service users and to fully perform the required service on the app.
Points of differences	Their study focused on one application, which is the Vezeeta application, while in our study we talked about many digital health applications in the Kingdom of Saudi Arabia.

Points of Similarities	Both studies talked about digital health applications, and both studies were conducted in an Arab countries, namely Egypt and the Kingdom of Saudi Arabia**.**
Study benefits	Benefiting from the results of the study and concluding the importance of the Vzeeta application in improving the quality of life and measuring this in terms of the importance of digital health applications and their role in improving health care services.

Study of (Etemad Muhammad Saleh Momena),2022.	
Title	Evaluating the use of health apps for outpatient clinics and primary health care centers in Riyadh
Study type	Article https://www.qscience.com/content/journals/10.5339/jist.2022.12#html_fulltext
Study community	Visitors to health facilities of five primary health care centers in Riyadh.
Sample size	517 outpatients from King Abdullah Medical City and five primary health care centers in Riyadh.
Study goal	This study aimed to reveal the social dimension in the acquisition of various technological means (health apps) to monitor and improve the health status of the individual and maintain his/her safety.
Study methods	They gave a general explanation of the topic in the form of an introduction**.** In this study, the descriptive survey method was used, as data was collected and then analyzed. The questionnaire was used as a tool to collect information related to the topic of the study, which is considered the most appropriate tool for collecting data and information on a wide range of people in different categories and according to their inclinations and orientations. In order to facilitate the implementation of this method, the oral inquiry method was used through Google Forms. In the end they gave a general conclusion outlining the main findings and information obtained through the study of this topic.

Study tools	Questionnaire
Main results	The results showed a low usage level of health apps and found positive and inverse correlations between gender, age and apps use. However, the facility and its visitors did not have a significant impact. The results also identified the most used health apps besides the usage of social applications
Points of differences	They focused on the health applications for outpatient clinics and primary health care centers in Riyadh, while our study was about health applications in Saudi Arabia in general.
Points of Similarities	Both of our studies were in Saudi Arabia and both of them wanted to raise health awareness to improve the quality of life.
Study benefits	Such a study opens horizons for other studies that would add great value to the use of health applications and enrich the Arab library with information that would enhance awareness of the importance of using digital health applications in the field of health services.

Study of (Aymen Bouzana, Wafa hamdouch) ,16/03/2022.	
Title	The shift towards using emerging digital health applications as a mechanism to face corona virus (covid-19): presenting the experiment of the two states of China and South Korea.
Study type	Article https://www.asjp.cerist.dz/en/article/188861
Study community	the two states of china and South Korea
Sample size	artificial intelligence, big data, 3D printing, the digital medical file .
Study goal	This study aims at showing the role of the shift towards using emerging digital health applications as a mechanism to face corona virus (covid-19). In the light of vulnerability of the public health section and the increase of the infectious number and the necessity of the digital transformation in the field the health care.

Study Methods	They gave a general explanation of the topic in the form of an introduction**.** To achieve the objective of the study the emphasis is put on presenting the experiment of the two states of china and South Korea and the efforts of the international health organization in the field of the emerging digital health applications, the artificial intelligence, big data, 3D printing, the digital medical file as digital mechanisms to mitigate the spread of the virus and limit its area of proliferation. In the end they gave a general conclusion outlining the main findings and information obtained through the study of this topic.
Main results	This study concluded that the use of digital health applications globally, especially in China and South Korea, has somewhat enhanced the efficiency of healthcare services and the response to COVID-19.
Points of differences	This study was based on showing the digital health applications as a mechanism to face corona virus, our study was based on showing the importance of digital health applications all the time.
Points of Similarities	The two studies showed the benefits of digital health applications
Study benefits	Benefiting in the analysis from global experiences such as the Chinese experience and the South Korean experience in the field of relying on digital health technologies and applications, Whether to confront crises and epidemics, or to improve health services**.**

Prepared by Benchikh tasnime, Boussoualim Maryam

Conclusion:

Digital health applications play an important role in improving the quality of healthcare services by allowing for more efficient data administration, personalised patient care, remote monitoring, and greater communication between patients and providers. As these technologies grow, they have the potential to alter healthcare delivery, promote better results, and ultimately improve the overall well-being of individuals and communities.

CHAPTER 2

THE EMPIRICAL STUDY

Preface:

After what we discussed in the previous chapter about the role of digital health applications in enhancing the quality of healthcare. Now in this chapter we are going to discuss the evolution of the healthcare system in Saudi Arabia and their achievements in the digital health sector and why we chose them specifically. finally we'll take a look into the most important digital health applications there.

Axe 1: Diagnostics of the Health care sector in Saudi Arabia

1.1 Evolution of the health system in Saudi Arabia

1.2 Health care indicators in Saudi Arabia

1.3 Challenges of health care services in Saudi Arabia

Axe 2: Digital health in of Saudi Arabia

2.1 The reality of digitization in Saudi Arabia

2.2 Digital health indicators in Saudi Arabia

2.3 Digital health challenges in Saudi Arabia

2.4 Digital health in Algeria

Axe 3: Digital health applications

3.1 Wasfaty application
3.2 Sehha application
3.3 Rasd application

Axe 1: Diagnostics of the Health care sector in Saudi Arabia

The Saudi health system has gone through many stages that were crucial in the development of the latter and in the quantity and quality of health services, as we will see in the following table :

Table (3) : Evolution of the health system in Saudi Arabia

Years	Events
1925	The Public Health Department was established this year.
1926-1927	The construction of health institutes and schools in Mecca was followed by the opening of health and emergency services as well.
1927	The construction of hospitals and the first hospital was named " quarantine " in Jeddah.
1951	The establishment of the Ministry of Health.
1952	The emergence of a series of hospitals in all cities of Saudi Arabia.
1953-1964	The number of hospitals reached 78, with 7,500 beds and 60 central and mobile medical clinics.
1970-1975	The vision of reaching the number of 1020 doctors and 3750 nurses.
1980-1990	Increasing the spending budget on the health sector .
1992	The issuance of laws clarifying the right of Saudi citizens to receive all the healthcare and welfare services.
1993-2005	Establishing numerous health councils and centers such as the health Insurance Council, the Saudi Health Council, and the health Specialties Authority, for the purpose of organization, monitoring, and improving quality.
2020	Launching the digital transformation program as an embodiment of Saudi Arabia's 2030 vision for the health sector, which aims to enhance public health and prevent diseases, deliver health services and free insurance to all citizens, and expand e-Health services and digital solutions.

Prepared by Benchikh Tasnime, Boussoualim Maryam, based on Abdulaziz Al-Rifdah, EMDRA, Pharm.D, A historical overview of the development of health regulations in Saudi Arabia, https://www.linkedin.com/pulse/.

1.2 Health care indicators in Saudi Arabia

Health indicators, whether demographic or economic, include many axes that illustrate the Kingdom of Saudi Arabia's progress in the field of health at all levels. It also indicates the exact numbers and percentages of hospitals and health facilities that have been completed over the past years. It also counts the number of doctors in various specialties and the estimated number of the population. In this requirement, we will review some of the indicators for the years 2019 and 2021**.**

Table (4) : demographic indicators

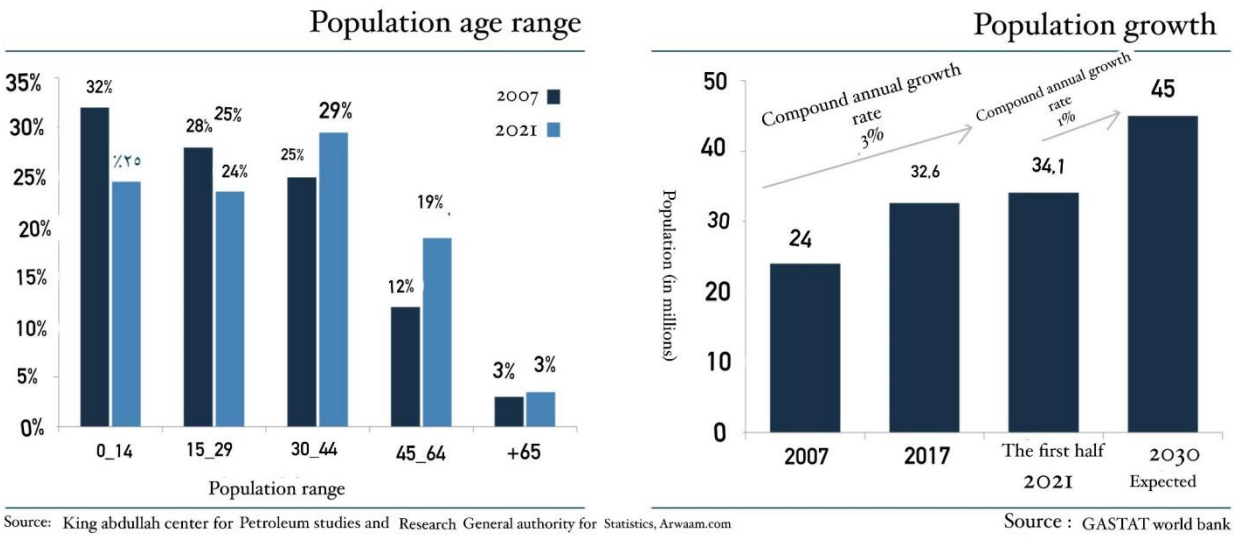
Health indicators	2019	2021
Total Area (Km2)	2,000,000	2,000,000
Population		
Estimated population	34 218 169	34,110,821
Saudi / total population (%)	62,0	63.6
Non Saudi / total population (%)	38,0	36.4
Annual growth rate for total population (%)	2,40	2.38
Life expectancy at birth (years)		
Males	73.6	73.7
Females	76.3	76.4
Overall	74.9	75.0

Source: Kingdom of Saudi Arabia Ministry of health, https://www.moh.gov.sa/En .

We notice from table n (4) that: the population in Saudi Arabia is decreasing, and the reason is due to the spread of the Corona pandemic in the world, which was the cause of the high number of deaths, and we also notice the decrease in the percentage of non-Saudi residents, as Saudi Arabia depends on religious tourism in its economic

income, and due to the quarantine period, the airports were closed, which led to a decrease in arrivals to the Kingdom.

Figure (2) : Population growth and population age range



Source : Aljazira capital**,** Saudi Arabia's healthcare sector: A promising outlook and accelerating growth, July 2022, p.3. https://www.aljaziracapital.com.sa/uploads/pdf/20220728023324-Healthcare%20Sector%20Report%202022%20-%20En.pdf

Life expectancy increased from 73.6 years old in 2010 to 74.3 years old in 2020, indicating a society with an increasingly improved healthcare system. So life expectancy could increase, as efforts to reduce avoidable accidents, such as traffic accidents and heart disease, as part of the Ministry of Health's National Transformation Strategy

Table (5) : vital statistics

Health indicators	2019	2021
Crude Birth Rate/ 1000 population*	**17,23**	**14.3**
Crude Death Rate/1000 population*	**2,9**	**2.4**

Source: Saudi Arabia Ministry of health, https://www.moh.gov.sa/En .

Table n(**5**) shows a decrease in the birth and death rate compared to 2019 due to the spread of the coronavirus pandemic.

Table (6) : health resources

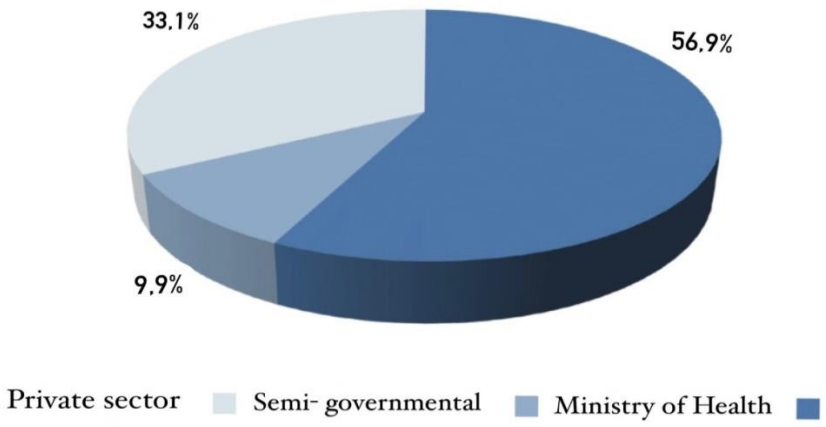
Health indicators	2019	2021
Total Hospital in KSA	498	497
MoH Hospitals	286	287
Private Hospitals	164	159
Total Beds (KSA)	76988	77224
PHCs (MoH)	2261	2121
Single Doctor Private Clinics	47	55
Private Polyclinics	2980	3732

Source: Saudi Arabia Ministry of health, https://www.moh.gov.sa/En .

We note in the previous table that most of the structures in Saudi Arabia have increased, such as MoH hospitals, private clinics, private polyclinics....

We also notice an increase in the number of beds, and this is also due to the Corona pandemic, as in that period it was necessary to provide a larger number of beds .

Figure (3) : Distribution of hospitals by sector (2020)



Source : Aljazira capital**,** Saudi Arabia's healthcare sector: A promising outlook and accelerating growth, July 2022, p.4.
https://www.aljaziracapital.com.sa/uploads/pdf/20220728023324-Healthcare%20Sector%20Report%202022%20-%20En.pdf

In the previous figure, we can see that the lion's share was taken by the Saudi Ministry of Health, followed by the private sector and finally the semi-governmental sector

Table (7) : colleges of medicine, dentistry and pharmacy

Health indicators	2019	2021
Governmental		
Colleges of Medicine	29	31
Colleges of Dentistry	13	20
Colleges of Pharmacy	22	22
Private		
Colleges of Medicine	9	8
Colleges of Dentistry	8	7
Colleges of Pharmacy	10	8

Source: Saudi Arabia Ministry of health, https://www.moh.gov.sa/En .

Table n(7) shows an increase in governmental medicine, dentistry and pharmacy colleges **.** We also note a shortage of private colleges.

Table n(8) : rates of health resources per 10000 population

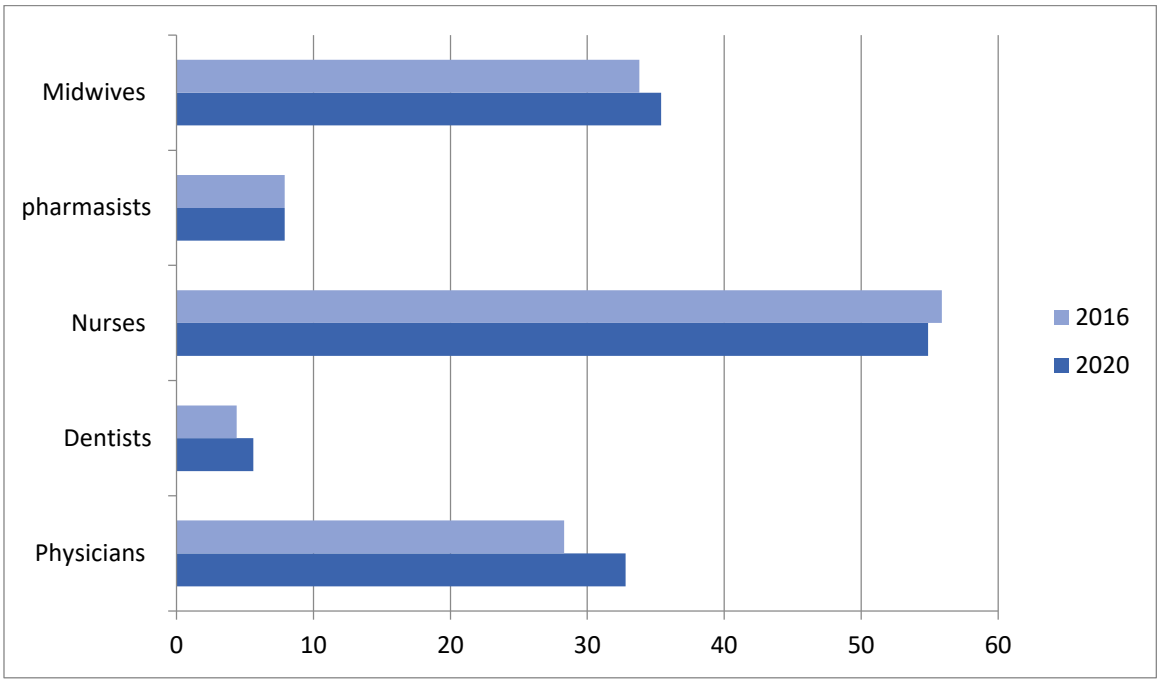
Health indicators	2019	2021
Physicians (KSA)	27.6	29.2
Dentists (KSA)	5.5	6.7
Nurses including Midwives (KSA)	58.2	59.1

Pharmacists (KSA)	**9.3**	**9.0**
Allied Health Personnel (KSA)	**36.1**	**38.4**

Source: Saudi Arabia Ministry of health, https://www.moh.gov.sa/En .

In the table above, we see an increase in the percentage of doctors, nurses and dentists…. which achieves sufficiency in this field

Figure (4) : rates of health resources per 10000 population



Source: Aljazira capital**,** Saudi Arabia's healthcare sector: A promising outlook and accelerating growth, July 2022, p.4.
https://www.aljaziracapital.com.sa/uploads/pdf/20220728023324-Healthcare%20Sector%20Report%202022%20-%20En.pdf

In the figure above, we see an increase in the percentage of doctors, nurses and dentists…. which achieves sufficiency in this field.

Table (9) : Total health manpower in KSA

Health indicators	2019	2021
Physicians (KSA)	94335	99617
Dentists (KSA)	18811	22739
Nurses including Midwives (KSA)	19913	201489
Pharmacists (KSA)	31872	30840
Allied Health Personnel (KSA)	132619	131003

Source: Saudi Arabia Ministry of health, https://www.moh.gov.sa/En .

We notice in table n(9) an increase in the percentage of doctors, nurses, dentists .... and a decrease in the number of pharmacists, all this is due to digital health applications such as my recipe, which enables the population to order medicine remotely, due to the quarantine period in the coronavirus pandemic.

Table (10) : percentage of Saudi in health sectors

Health indicators	2019	2020
PHCCs & OPD Visits (in million)	153	117
Inpatients (in Million)	3,6	2.8
Surgical Interventions (in Million)	1,4	1.8
Lab. Investigations (in Million)	386	358
Radiology Investigations Patients (in Million)	22.1	18.1
Average No. of Visits/Person/Year	4.5	3.4

Source: Saudi Arabia Ministry of health, https://www.moh.gov.sa/En .

We are seeing in the table above a decrease in the number of patients visiting the health sectors, which is due to health care services that focus on prevention rather than treatment.

Table (11): public health

Health indicators	2019	2020
Basic Immunization Coverage (%)		
Hexa. Vaccine (Diphtheria, Pertusis, Tetanus, Hib, Hepatitis B, inactivated polio)	97	97.4
Oral Polio Vaccine (OPV)	97.5	97
BCG Vaccine	98	96
MMR Vaccine (Measles, Mumps & Rubella)	96.5	96.4
Pneumococcal Conjugate Vaccine (PCV)	97	97
Incidence Rate /100،000 Population		
Poliomyelitis	00	00
Whooping Cough	0.75	0.28
Measles	2.99	0.10
Pulmonary TB	6.62	5.42
Extra Pulmonary TB	2.16	1.75
Neonatal Tetanus/1000 Live Birth	00	00

Source: Saudi Arabia Ministry of health, https://www.moh.gov.sa/En .

From the table n(11) We observe a decrease in the use of some vaccines.

Through the tables, we notice that the Kingdom of Saudi Arabia is striving to provide better health services with the best technology, as we see that with each passing year :

- An increase in the number of health facilities, whether public or private, to provide the best services to patients as soon as possible.
- Increase in the number of doctors, nurses, pharmacists, dentists .... whether they are students or workers, which provides the country with greater development and expansion in this field, whether in terms of research or services .
- A decrease in the mortality rate and an increase in the birth rate over the years, which shows the high efficiency of doctors, which indicates the quality of training provided by the state in this field and its provision of all the necessary means and techniques for treatment .
- Few or no epidemics at all. All this is due to the quality of the service provided.

All of this shows that Saudi Arabia strives to minimize all errors in the health sector while developing it to provide the best possible service to patients.

1.3 Challenges of health care services in Saudi Arabia

Saudi Arabia has made significant progress in its healthcare system through increased healthcare spending, improved healthcare infrastructure, and better quality of care. The government has introduced initiatives such as universal health coverage, accreditation programs, and healthcare technology adoption. Despite the progress made, the healthcare system in Saudi Arabia still faces numerous challenges. The following are some of the challenges facing the system:

- **Shortage of Healthcare Workers:** There is a shortage of healthcare workers in Saudi Arabia, particularly in rural areas. The majority of healthcare professionals are concentrated in urban areas, resulting in underserved rural areas. According to a report by the Saudi Arabian General Investment Authority (SAGIA), the country has a deficit of around 15,000 doctors and 20,000 nurses. This shortage has resulted in longer wait times and reduced access to healthcare services. The government has implemented several initiatives to address this challenge such as the establishment of new medical schools and the recruitment of foreign healthcare professionals.
- **Lack of Preventive Care**: The healthcare system in Saudi Arabia focuses more on curative care than preventive care. This has resulted in higher rates of non-communicable diseases (NCDs) such as diabetes, cardiovascular disease, and obesity. NCDs are the leading cause of mortality in the country, and their prevalence is increasing. The government has implemented several programs to address this issue, including the National Program for Prevention and Control of Diabetes

and the Saudi Heart Association. However, more needs to be done to reduce the prevalence of NCDs and improve the health outcomes of the population.

- **Limited Private Health Coverage:** MOH statistics indicate that employers are typically the primary providers of private health insurance policies in Saudi Arabia. Employees and their dependents are often covered under these schemes as part of their employment benefits. The schemes accounted only for around 67% of all private health insurance policies in 2020. Hence, more than 30% of the population relied on public healthcare services provided by the MOH. This has resulted in overcrowding in public healthcare facilities and longer wait times.
- **Limited Mental Health Services:** Mental health services in Saudi Arabia are limited, and there is a stigma associated with mental health issues. Because of the cultural attitudes toward mental health as well as a lack of awareness and understanding about mental illness, mental health issues have been underreported significantly in the country. Also, another challenge is the shortage of mental health professionals, particularly in rural areas. According to the WHO, there are only 2.2 psychiatrists per 100,000 people in Saudi Arabia, which is significantly lower than the global average of 9.0 psychiatrists per 100,000 people. This has resulted in a lack of access to mental healthcare services.
- **Restricted Healthcare Financing**: The healthcare system is primarily funded by the government, and there is a need to explore alternative financing mechanisms to ensure the sustainability of the healthcare system.[1]

[1] Swathi Gurajala, Healthcare System in the Kingdom of Saudi Arabia: An Expat Doctor's Perspective – PMC, National library of medicine, vol(15), Iss(5), 2023.

Axe 2: Digital health in Saudi Arabia

Saudi Arabia is keen to achieve a smart government and is constantly investing in its infrastructure. 5G digital networks are spreading and 6,500 new towers are being built to contribute to achieving the Kingdom's Vision 2030 using big data. The Digital Government Authority was established and digital interactions and electronic services were established between citizens, the government and the business sector. To create an ecosystem for digital transformation, it is necessary to invest in investment capital, ease of doing business, be prepared to adopt digital transformation, be prepared to adopt innovation, development and digital capabilities of the workforce, be prepared for the risks of organizing projects for innovative ideas, attracting foreign investment and international companies, and enhancing digital and technological knowledge[1] .

2.1 The reality of digitization in Saudi Arabia

The year 2020 is an exceptional year by all standards for Saudi Arabia, despite the repercussions of the Corona pandemic. The Kingdom has made achievements that made it occupy a global position in international reports, as it recorded impressive progress for the second year in a row in the report (Women, Business Activities, and Law 2021). It also recorded the only progress in the Middle East and North Africa and was ranked eighth among the twenty countries in the World Competitiveness Yearbook. These achievements came through procedural and legislative reforms that exceeded 555 reforms implemented by the trade system and its partners in the public and private sectors, through the initiatives of the National Transformation Program to improve the business environment).

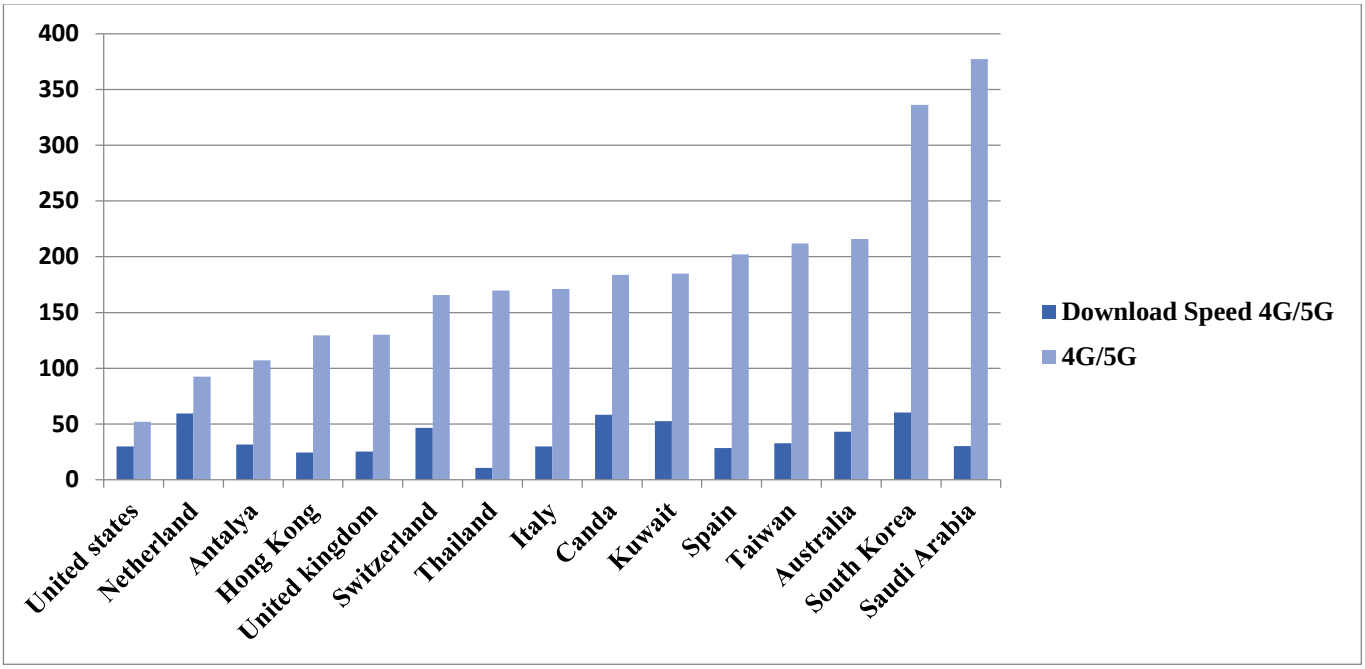
The National Transformation Program aims to develop the necessary infrastructure and create an enabling environment for the public, private and non-profit sectors to achieve the Kingdom's Vision 2030, by focusing on achieving excellence in government performance, supporting digital transformation, contributing to the development of the private sector, promoting community development, and ensuring the sustainability of vital resources.

Within the framework of Vision 2030, Saudi Arabia has witnessed a qualitative growth in e-commerce and business models for digitally provided services, including health care services. It has achieved several levels, through the National Transformation Program, which it was launched from 2016 until the end of 2020, and among the most prominent of these achievements are the following:

[1] Report No. (110) Artificial Intelligence and Healthcare in the Kingdom The Future Revolution for Better Health, Aspar Center Forum, Saudi Arabia, August 2023, p10.

- **The title of the most advanced country in digital competitiveness**: within the Global Progress and Competitiveness Report 2020 from the European Center for Digital Competitiveness, which is based on the Competitiveness Report of the World Economic Forum. The Kingdom of Saudi Arabia scored 149 points, ahead of France, China, Japan, the United Kingdom, the United States of America and Germany.
- **Achieving the second rank in the allocation of frequency bands**: where the Kingdom has embarked on implementing the digital transformation plan by developing the national plan for the frequency spectrum, and prioritizing the evacuation, redistribution and allocation of frequency bands, which contributed to the Kingdom achieving the fourth place globally in the spread of the fifth generation technology.
- **Covering remote areas with wireless broadband**: which contributed to:
    - Complete the delivery of basic communications services by 100% in rural and desert areas.
    - Improving the quality of basic telecommunications services provided;
    - Covering more than 576,000 homes in isolated areas with wireless broadband by the end of 2020, compared to 58,000 homes previously in 2017.
- **Improving the quality of digital services provided to beneficiaries**: through:
    - Covering more than 3.5 million homes with an optical fibre network in 2020, where it was previously 1.2 million in 2017, and connecting it to all regions of the Kingdom in cooperation with the private sector;
    - Increased Internet traffic during the Corona pandemic by 30%;
    - Double the internet traffic through the national internet switchboard;
    - Increasing internet speed from 9 Mbit/s in 2017 to 109 Mbit/s in 2020.
- **Getting the first place in the average download speeds for 5G service**: according to the report “Measuring the experience of users of 5G networks” issued by Open Signal in October of 2020, which is a report that measures the average download speeds of 5G networks in fifteen leading countries Globally in the deployment of the fifth generation networks, the Kingdom of Saudi Arabia came at the forefront of the list of download speeds for the fifth generation networks, as shown in the figure below.

Figure (5) : Average download speeds of 5G networks, in 15 of the world's leading 5G deployment countries (2020)



Source: Annual Report: The Transformation Continues, - The most prominent achievements of the National Transformation Program until the end of 2020, Saudi Arabia (Vision 2030), 2021,p.52.www.vision2030.gov.sa

From the figure, we note that the Kingdom of Saudi Arabia ranked first in the average 5G download speed, at a speed of 377.2 Mbit/s, surpassing South Korea, the first country in the rate of 5G network coverage at a speed of 336.1 Mbit/s.

- **Supporting open source solutions**: The "Masdar platform" was launched, which is an integrated platform for Saudi government agencies, public and private companies, universities and research institutions for open source software, which contributes to stimulating digital innovation and developing the software market.
- **Launching the largest advanced cloud center for Google in the Kingdom**: The Kingdom of Saudi Arabia was added to the areas covered by the global network of the Google cloud platform, as part of the strategic alliance agreement signed by Saudi Aramco with Google Cloud with the support of the Ministry of Communications and Information Technology. Partnership in supporting entrepreneurs and companies through:
    - Effort reduction by 70%;
    - Reduce costs by 30%.
- **Launching the (Ali Baba Cloud) Center for Cloud Computing in Riyadh:** in partnership with the Saudi Telecom Company (STC) and with the support of EWTP Arabia Capital, where $500 million was invested in the Kingdom of Saudi Arabia as part of this partnership in pursuit of digital sustainability.

- **Launching the first center in the Middle East and North Africa for cloud computing**: The center is one of 20 centers around the world, which contributes to promoting a culture of technical innovation and advancing digital transformation.
- **Launching the Digital Knowledge Platform (ThinkTech):** The platform contributed to:
    - More than a million beneficiaries of digital content and 100,000 beneficiaries of events;
    - Launching the "IBM Digital-Nation" platform, in partnership with IBM, to provide a wide range of courses at different levels in emerging technologies, and to make a qualitative leap in the mechanism of information delivery, and to provide innovative solutions and modern and advanced educational experiences.
- **The Digital Giving Initiative**: The initiative (World Summit on the Information Society Prize 2020), presented by the International Telecommunication Union in the path of cultural and linguistic diversity and local content, achieved first place, and this initiative contributed to the launch of the "Ithra" platform, which aims to provide virtual classes to provide educational lectures Remotely.
- **Launching the "Tech Pioneers Program**";
- **Launching the Digital Determination Camps**: It aims to qualify and qualify recent graduates and job seekers, through multiple, intensive, qualitative and specialized training camps.
- **stimulating digital entrepreneurship**;
- **Empowering women in technology**: The Ministry of Communications and Information Technology attaches great importance to empowering women in the ICT sector. Therefore, the Ministry launched the Women Empowerment Program to activate the role of women in the ICT sector. The program has contributed to:
    - The Kingdom of Saudi Arabia received the International Prize for Empowerment of Women in Technology from the International Telecommunication Union;
    - The rate of women's participation in the communications and information technology sector and professions increased to 22.91% in the third quarter of 2012.
- **Launching the "Future Skills" initiative**, which aims to build a sustainable model to reduce the gap in the labour market between offers and demands in the fields of communications and information technology.
- **International Hope Hackathon**: In terms of empowering local and global talent, and with the aim of developing digital business solutions to the challenges caused by the Corona pandemic, the Ministry of Communications and Information Technology launched the (Hope Hackathon) remotely, in

cooperation with more than 25 local and international partners in order to come up with innovative ideas and solutions to challenges In three different paths:

- Digital health
- Home entertainment
- Electronic games

- **Progress in the United Nations E-Government Development Indicators 2020 :**

In the following table, we will show the progress of Saudi Arabia in the United Nations indicators of e-government development for both 2018 and 2020.

Table (12) : The progress of Saudi Arabia in the United Nations indicators of e-government development

The United Nations assessment of e-government development index			
2018	52 Globally	2020	43 Globally
The progress of Saudi Arabia: 9 places 12 between 20G			
The Communications Infrastructure Index			
2018	67 Globally	2020	27 Globally
The progress of Saudi Arabia: 40 places 8 between 20G			
the Human Capital Index			
2018	50 Globally	2020	35 Globally
The progress of Saudi Arabia: 15 places 10 between 20G			

Source: Annual Report: The Transformation Continues, - The most prominent achievements of the National Transformation Program until the end of 2020, Saudi Arabia (Vision 2030), 2021, p. 52.www.vision2030.gov.sa

- Through the above table, we note that the Kingdom of Saudi Arabia has made progress in the United Nations assessment of e-government development index, as it advanced 9 positions during 2020 compared to 2018, and ranked 12th among the G20. It also advanced in the Communications Infrastructure Index by 40 places in 2020 compared to 2018, and the Human Capital Index by 15 places, where it ranked 35 globally in 2020 compared to 2018, when it ranked 50 globally.

- **Launching the "Digital Governance Council" development system**: through the "Yesser" e-Government Program, which is a smart system that provides integrated digital solutions that contribute to facilitating and effective government meetings of the Kingdom's Governance Council.

- **Adopting and developing comprehensive government concepts**: by launching a number of platforms and electronic services that aim to enhance the principle of integration in providing services between government agencies to provide a unified and safe experience for all beneficiaries.

- **The high rate of maturity of digital government services**: Digital government services recorded an improvement of 35.5% between 2018 and 2020, according to the report (The Maturity Index of Digital Government Services), of the e-Government Program (Yesser), which showed a high maturity rate. Digital government services to 81.3% in a number of sectors, including:
    - health sector;
    - The services and development sector;
    - The transport and communications sector;
    - The labor sector and workers;
    - Justice and Islamic Affairs Sector;
    - The financial and commercial sector

2.2 Digital health indicators in Saudi Arabia

- **Using modern technologies and focusing on innovation**

With many digital health tools already implemented, broader Innovation is at the top of leaders' priority list today The pandemic accelerated the implementation of certain technologies, such as digital health tools, which have since proven to make healthcare delivery faster and cheaper.

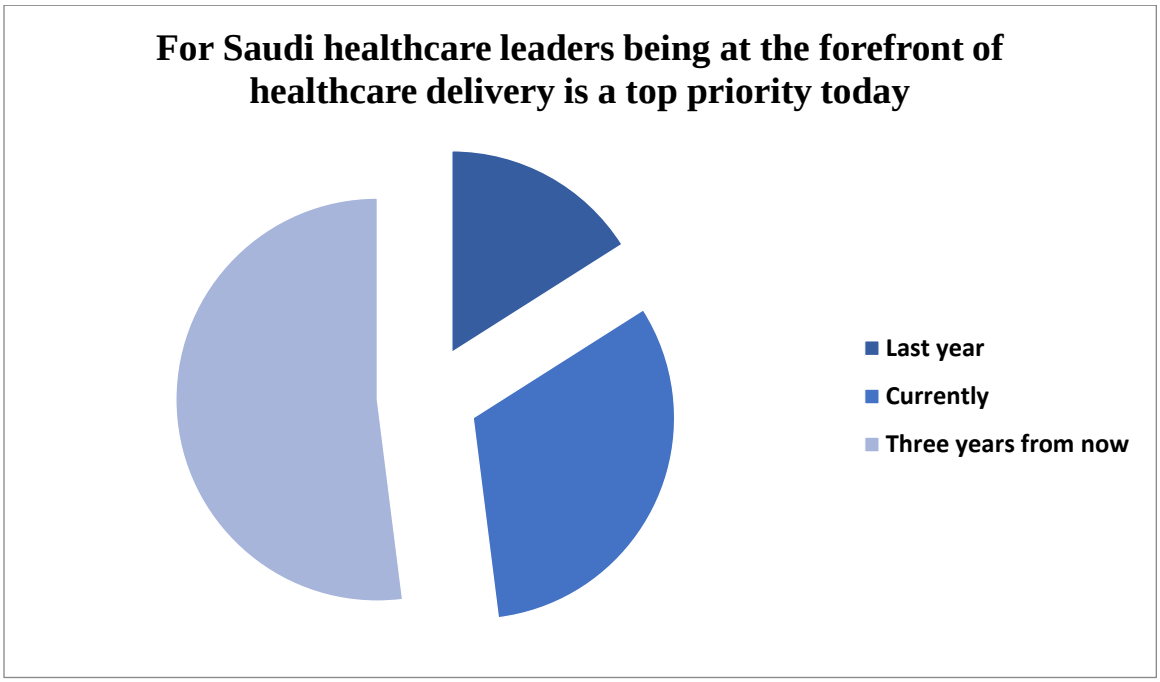
As a result, many remote care solutions are already in place in Saudi Arabia, and health care leaders can prioritize being innovative and research-driven on a broader scale. Today, more than one-quarter (26%) of healthcare leaders in Saudi Arabia say that being at the forefront of healthcare delivery is their top priority. This is a three-fold increase compared to 2021.

Saudi Arabian healthcare leaders are also focused on expanding care. One-fifth (22%) of Saudi leaders cite extending care delivery beyond the hospital walls as a top priority today and 26% expect to prioritize it in three years' time.

Digital innovations in healthcare have undoubtedly contributed to the Kingdom's steady innovation growth, reflected in the Global Innovation Output Index (Saudi Arabia was placed at #85 in 2019, #77 in 2020 and #66 in 2021). Implementing further technological advances to address some of the Saudi healthcare system's lasting challenges, such as those related to primary healthcare, will continue to

support facilities on their journey to the forefront of healthcare delivery, both inside and outside the hospital[1]. The following figure shows this:

Figure (6) :Expanding the scope of providing health care services in Saudi Arabia because of Digital innovations in healthcare



Source : philips-future-health-index-2022-report-healthcare-hits-reset-saudi-arabia-arabic, p.6. https://www.philips.sa/a-w/about/news/future-health-index/reports/2022/healthcare-hits-reset.html

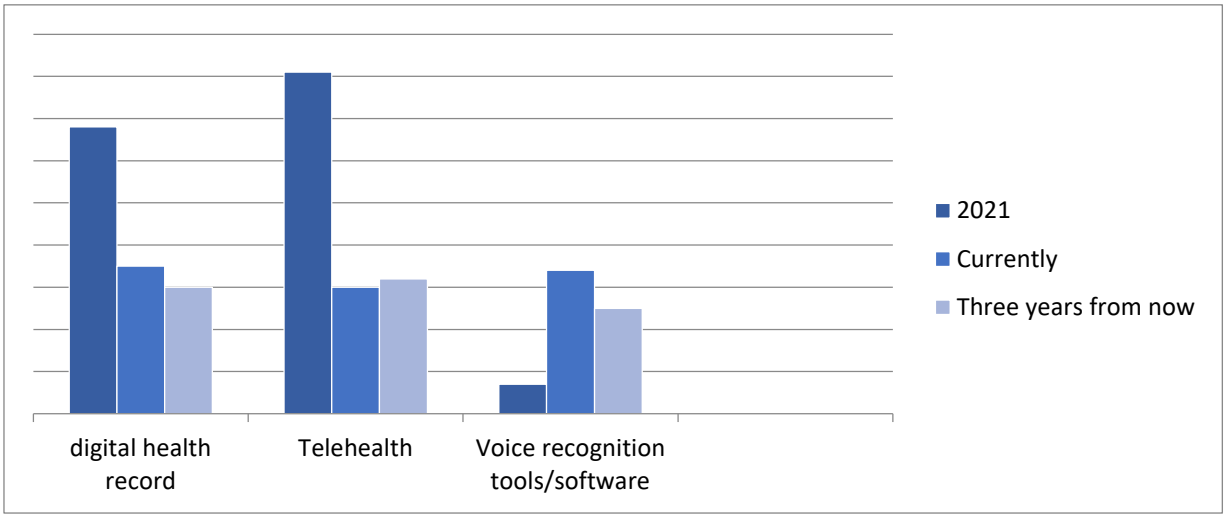
It is likely that technology investments made by healthcare leaders in Saudi Arabia, as part of their drive to be at the forefront of healthcare delivery, will also help to improve staff satisfaction by reducing workloads and streamlining onerous administration tasks.

2- Invest in telehealth, digital health records and new data-driven technologies

With digital health records in place and telehealth becoming a norm, leaders seek ways to make technology more user-friendly Saudi Arabian healthcare leaders are continuing their journey to improving healthcare with new, data-driven technology. The country's government is also committed to meeting the needs of the changing healthcare landscape by providing guidance and regulation of new health technologies.

[1] philips-future-health-index-2022-report-healthcare-hits-reset-saudi-arabia-arabic, p(6), https://www.philips.sa/a-w/about/news/future-health-index/reports/2022/healthcare-hits-reset.html .

Figure (7) :Invest in telehealth, digital health records and new data-driven technologies



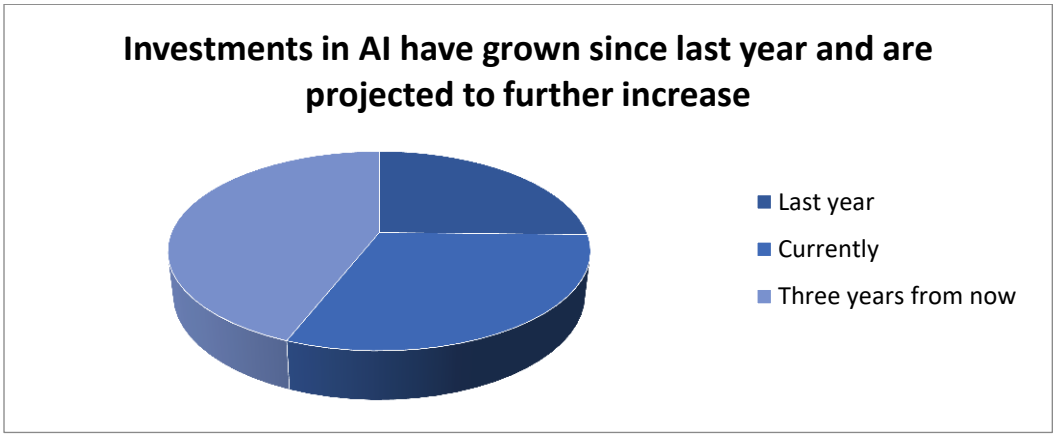
Source: philips-future-health-index-2022-report-healthcare-hits-reset-saudi-arabia-arabic,p.9. https://www.philips.sa/a-w/about/news/future-health index/reports/2022/healthcare-hits-reset.html

In 2021, Saudi Arabian healthcare leaders focused their investments on core technologies crucial for remote care, necessitated by the pandemic. In 2021, 81% prioritized investments in telehealth, and more than two-thirds (68%) made allocations in their budgets for digital health records. Today, with remote technologies in place in most facilities, they are no longer the top investment in Saudi Arabia. The country's healthcare leaders have cut investments in telehealth by 35 percentage points and digital health records by 33 percentage points. Meanwhile, more advanced data-driven technologies gained a larger share of investment budgets. Voice recognition tools, only purchased by 7% of healthcare leaders in 2021, are now a key area of spending for more than one-third (34%). This is markedly ahead of other countries including the United States.

- **Investing in artificial intelligence**

Artificial intelligence plays a major role in healthcare , where the integration of machine learning and processing occurs Natural language and computer vision revolutionize the healthcare industry, by providing a range of revolutionizing solutions for better health, from more accurately identifying diseases to developing treatment plans Personal. Artificial intelligence technology can also improve the patient experience and assist in treatment Some of the pressing issues facing health care today

Figure (8): Investing in artificial intelligence

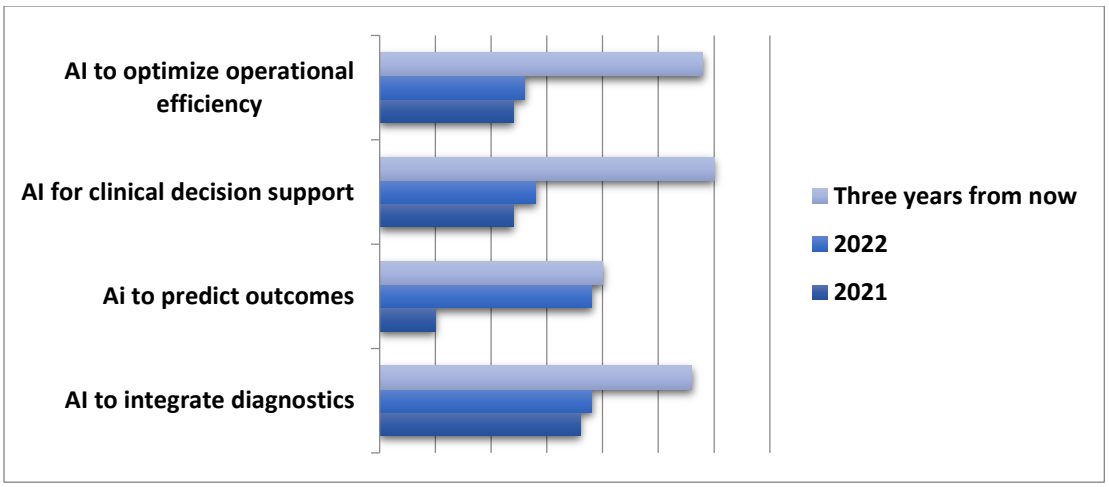


Source: philips-future-health-index-2022-report-healthcare-hits-reset-saudi-arabia-arabic, p.13. https://www.philips.sa/a-w/about/news/future-health-index/reports/2022/healthcare-hits-reset.html

Despite obstacles to data utilization, Saudi Arabia's healthcare leaders recognize the promise of data-based technologies, like AI, in healthcare and are committed to furthering their adoption.

The Future Health Index 2021 showed relatively high levels of investment in AI among Saudi Arabian healthcare leaders. Building upon this trend, AI investment levels are even greater this year with close to half (46%) of them citing AI as a key investment area today .This figure, notably higher than in 2021 (38%), is expected to further increase. Three years from now, two-thirds (66%) plan to invest in the technology.

Figure (9): Investments in different areas of AI application



Source : philips-future-health-index-2022-report-healthcare-hits-reset-saudi-arabia-arabic, p.13. https://www.philips.sa/a-w/about/news/future-health-index/reports/2022/healthcare-hits-reset.html

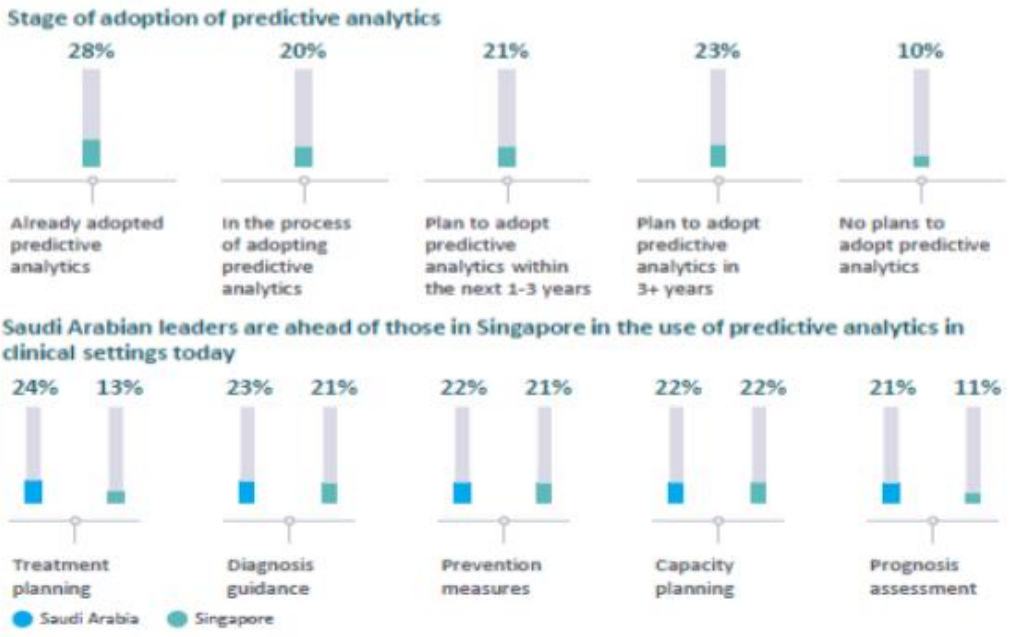
Looking more closely at the areas of AI in which Saudi Arabian healthcare leaders are investing, clinical applications, like integrating diagnostics and clinical decision support, currently receive the most attention.

Leaders focus on investing in AI for use in operational settings in the near future The highest growth in AI investments (16 percentage points) within the next three years is expected in operational settings. Thanks to this increase, investments in AI for operational and clinical uses will be on par in three years' time.

- **Predictive analytics use**

While Saudi Arabian healthcare leaders see AI as a key investment area, many are already utilizing predictive analytics in some capacity. Over one-quarter (28%) say their hospital or healthcare facility has already adopted the technology, with another 20% currently in the process of doing so, putting Saudi Arabia (48%) on par with the European average (47%) in terms of predictive analytics utilization

Figure (10): Predictive analytics use



Source : philips-future-health-index-2022-report-healthcare-hits-reset-saudi-arabia-arabic, p.14. https://www.philips.sa/a-w/about/news/future-health-index/reports/2022/healthcare-hits-reset.html

As with AI adoption, predictive analytics are more likely to be used today in clinical settings (87%), supporting tasks such as treatment planning (24%), diagnosis guidance (23%) and prevention measures (22%).Saudi Arabian healthcare leaders are far ahead of their counterparts in Singapore when it comes to the use of predictive

analytics in clinical settings. However, when asked about the areas where their facilities could most benefit from predictive technologies, leaders first indicate operational uses (86%), with predicting healthcare professional-to-healthcare professional variability (28%) and scheduling and utilization (27%) coming out top.

2.3 Digital Health Challenges in Saudi Arabia

According to the latest statistics, the value of the global industrial robotics market and investment in artificial intelligence amounted to about 48.5 billion dollars in 2022, and is expected to reach 142.8 billion dollars in 2032 at a compound annual growth rate of just over 11.4% between 2023 and 2032.

The percentage of investment in digital health and its applications, most notably artificial intelligence, while indicating its importance and its role in improving health services for the latter, it is certain that the challenges it faces are many despite the high need, as the topic of linking digitization and health care is a choppy sea of opportunities, challenges, developments and changes, and it is also opportunities to achieve scientific and technical superiority and precedence in its various parts.

Although Saudi Arabia ranks second in terms of awareness and knowledge of the importance of artificial intelligence, as well as the efficiency of the health sector, it remains like other countries in the world, especially the opportunities for digital health and the challenges it faces during the response to the COVID-19 pandemic, including the costs of implementing digital health, weak and fragmented governance, data security, privacy, lack of protection from risks due to misuse, and language barriers.

This is in addition to:

- The exceptional information revolution and digital transformation that the Kingdom is undergoing is an exceptional precedent. The most prominent result of this progress is the abundance of data, which is considered the main fuel for the majority of emerging technologies

Chief among them is artificial intelligence. However, these technological advances require parallel legislative and regulatory advances.

- The adoption of artificial intelligence in healthcare faces some unique challenges that must be overcome before implementation is possible. The most important challenges can be categorized as follows:
    - Regulations and policies
    - Data privacy
    - Ethical concerns
    - Patient harm due to artificial intelligence errors
    - Misuse of medical artificial intelligence tools
    - Risk of bias in medical artificial intelligence and continued inequality

- Cybersecurity risks
- Compatibility and interoperability issues
- High cost
- Trust and acceptance of systems by stakeholders
- Gaps in accountability and responsibilities in artificial intelligence governance[1]

2.4 Digital health in Algeria

The health sector has become increasingly important as epidemics and diseases are on the rise around the world. Algeria, like other countries, has resorted to adopting a digital strategy to face the current challenges, and the use of technology has become imperative to respond to the requirements of citizens, especially patients at the level of healthcare services.

Algeria, like other countries in the world, seeks to invest in its available resources and capabilities, whether material, human or financial, and to exploit them technologically in order to provide health care to all citizens, and therefore we will address the efforts of the Algerian government to digitize the health sector through the launch of several digital platforms, including:

2.4.1Digital health service platforms in Algeria

E-Health platforms allow patients to access specialized healthcare in their homes, recommending care pathways in a safe and secure environment, all the patient needs is a webcam, internet access, and a willingness to connect. Here are some examples of eHealth platforms in Algeria:

The digital platform of the Ministry of Health:

- **The e-platform of the Ministry of Health:** is a result of the state's orientation towards the development of digital content and telehealth services, as well as the gradual digital transformation in various fields and at the level of all institutions.[2]
- **Etisalat Algeria's digital platform:** Etisalat Algeria has created an online platform that serves as a dashboard for various health services. Through this online platform, citizens can request medical assistance by entering their phone number, answering a series of questions about their health status, and then being contacted by health services[3].
- **The Beesiha platform:** the first digital platform related to the health sector in Algeria, called “Beesiha,” was launched. This platform allowed doctors and patients to use it for free starting June 2020, by downloading it on smartphones or the website, enabling them to book appointments and consultations remotely. The platform allowed more than 512 doctors to access it during the trial period as they will

[1] Artificial Intelligence and Healthcare in Saudi Arabia: The Future Revolution for Better Health, op.cit, p44.
[2] Clach, K. & Bouhafs, S, The emergence of eHealth as a mechanism to confront the Coronavirus in Algeria, Journal of Human Resource Development, vol(17), Iss(1), 2022, pp (336-360).
[3] Algerian News Agency. Algeria Telecom develops website and app on coronavirus. Retrieved September 22, 2021. Available at: https://www.aps.dz/ar/sante-science-technologie/85721-, 2020.

supervise the scheduling of appointments for their patients remotely, and the application is equipped with GPS technology, as it allows the patient to provide information about the doctor's location, name, specialty and time, which enables him to schedule a consultation according to his digital agenda. At the same time, it enables doctors to track their patients remotely and inform them about the type of medications they consume or even the side effects they may experience[1].

- **E-Tabib platform:** is a local electronic platform that provides free remote medical services during the quarantine period, the first of its kind in the field of remote medical consultation with video technology in the African continent, which was launched coinciding with the outbreak of the Corona pandemic in the country, using a phone or computer, as the platform is available on mobile phones through the Play Store application, and the registration process is very easy, as the patient chooses his doctor, then an audio or video conversation is opened between them. The initiative aims to relieve pressure on hospitals and allow patients to resume their medical appointments remotely in light of the measures taken to limit the spread of the coronavirus. E-Tabib, which has chosen the slogan "No more fatigue", aims to change the practice of medicine by employing modern technologies in the field.[2]
- **Docta platform:** a group of Algerian talents launched an online health platform for doctors and citizens to ensure a more accessible healthcare experience, called "Docta." This new idea in Algeria came within the framework of the need for digital solutions that keep pace with reality and improve the healthcare experience in the country, especially in light of the coronavirus pandemic. Docta aims to organize medical appointments, manage patients' medical information and files on a single platform, and improve the doctor-patient relationship by facilitating communication between them[3].
- **Bivotal App**: on July 21 of this year, the Clinique du Val Group launched the BIOVAL APP, part of the process of developing a high-quality medical service at home, combining reliability and speed. This application allows patients to make an online appointment for medical tests at home, at the same prices as in medical laboratories, meaning that transportation costs will be free and unlimited. The app offers a wide range of specialized medical tests processed on the latest

[1] Hlally, H. (2020), https://www.elbilad.net/national .
[2] Radio Algerienne, 2020, "etabib.dz", a platform for consulting a doctor by video, consulted 09.25.2022. On: https://radioalgerie.dz/news/fr/article/20200330/191674.html .
[3] Kaabesh, E. 2021. Algeria. Launching a digital health platform that connects patients with doctors. From Sky News Arabia. Retrieved 21 09, 2022. Available at: https://www.skynewsarabia.com/middle-east/1455269- .

generation of equipment, which primarily serves social groups with limited mobility or those living in isolated areas[1].

- **Electronic medical file:** Hoping to improve the quality, efficiency, effectiveness and safety of health care, most countries are investing in the computerization of their health systems, Algeria is also engaged in interaction with health partners in foreign countries in order to reach a more efficient health care system. In this context, in 2012, Algeria, in cooperation with the European Union, selected the Oran Hospital Foundation as a pilot site because of the best standards required to implement this project and also because it responds to the natural extension of the quadruple mission of hospital centers and institutions, namely: Prevention, treatment, education and research[2].

[1] SANTENEWS-DZ. (2022). Medical Digital "BIOVAL APP", consulted 09 28, 2022. On: https://www.santenews-dz.com/medical-digital-bioval-app/ .

[2] Tahri taiba, Tahri Fatima Zohra, the reality of electronic medical record implementation in Algeria, journal of human sciences, vol(47), 2017, p(287).

Axe 3 : Digital health applications

There are a lot of digital health applications that are so effective and helpful for the community in the Kingdom of Saudi Arabia, as Wasfaty application, Rasd application, Mawid application, 937 application , Sehha application…
The following table shows this :

Table (13) : The most important e-Health applications in the Kingdom of Saudi Arabia[1]

Electronic Applications	Wasfaty Application	Rasd Application	Mawid Application	937 Application	Sehha Application
	وصفتي wasfaty	رصد	موعد	937	صحة

Source: Annual Report: The Transformation Continues, - The most prominent achievements of the National Transformation Program until the end of 2020, Saudi Arabia (Vision 2030), 2021, p. 52.www.vision2030.gov.sa

In this Axe we choose three of them to talk about .

3.1 Wasfaty application

وصفتي wasfaty

Definition:

It is an advanced electronic service that aims to raise the level of health services and ensure the availability of medication by linking hospitals and primary health care centers with community pharmacies to make it easier for the patient to receive the medications from the nearest pharmacy for free, it is also one of the latest NUPCO projects . NUPCO is the leading company in Saudi Arabia in procurement, logistics and supply chain management for pharmaceutical , medical devices and supplies for governmental hospitals in the Kingdom of Saudi Arabia.
Among the most important achievements of this system during the end of 2023 are the following [2]:

[1] Annual Report: The Transformation Continues, - The most prominent achievements of the National Transformation Program until the end of 2020, Saudi Arabia (Vision 2030), 2021, p(52).
[2] https://wasfaty.sa , consulted on 22-05-2024, 15:39.

- Available in 172 city .
- 35.6 million electronic prescriptions.
- Connecting 225 hospitals and 2086 primary care centers to the system
- 3197pharmacies registered.

Wasfaty initiatives:

- **Home delivery**: The home delivery initiative was launched during the curfew period (covid19) in the Kingdom's cities to provide medicine to beneficiaries in their homes by contacting the customer service 920000932, especially during the full curfew in some cities that may make it difficult to obtain medicine for some beneficiaries who are elderly, chronically ill, and people with disabilities. The objective of this initiative is to ensure that beneficiaries have access to their medicines for continuity of treatment without being affected by the curfew situation that may hinder them from reaching the location where they receive the medicine, whether at the community pharmacy or the health facility.

- **eRx delivery:** The Coronavirus (COVID-19) Medication Delivery Initiative is the delivery of prescriptions issued to quarantined beneficiaries through the "Wasfaty" service so that the treating physician in quarantine can write the prescription electronically through the Wasfaty service system after the patient's diagnosis, in order to improve the health care services provided to patients and ensure the continuity of treatment. The objective of this initiative is ensure that beneficiaries have access to their medicines for continuity of treatment without being affected by the curfew situation that may hinder them from reaching the location of receiving the medicine, whether at the community pharmacy or the health facility.

- **Refill eRx:** The "Prescription Reissuance for People with Chronic Diseases" initiative is to provide the service of refilling medicines for beneficiaries with chronic diseases through the "My Recipe" service, where the beneficiary can contact the "My Recipe" customer service center 920000932 to communicate with the treating doctor to review the patient's file and reissue the prescription to be able to receive the medicine from community pharmacies participating in the service without the need to visit the primary health care center or the hospital. The objective of this initiative is re-issuing prescriptions for people with chronic diseases issued by health facilities participating in the Wasfaty service during the COVID-19 crisis, to support beneficiaries when they cannot visit a primary health care center or hospital.

Following precautionary measures to limit going out from home and avoid crowds and gatherings.

Wasfaty goals:

- Enhancing the efficiency of the medication dispensing process by automating and organizing the distribution of orders to community pharmacies and transportation companies
- Providing equal opportunities for community pharmacies to dispense medicine.
- Providing opportunities to benefit from the service to qualified beneficiaries.
- Complementing Wasfaty services with transportation and home delivery services[1].
- Alignment with Vision 2030, through continuous development of healthcare services.
- Increasing the satisfaction rate of beneficiaries with the services provided.
- Build a contingency plan for epidemics and external risk factors.
- Saving costs for government health agencies by standardizing delivery prices[2].

3.2 Sehha application

Definition:

Sehha is an application to provide innovative and sustainable solutions, keep pace with digital transformation and employ artificial intelligence in the provision of medical services. It was launched to enable individuals to receive health and preventive care from their homes, through medical consultations via text, audio and video chats, provided by specialized doctors accredited by he Ministry of Health, in addition to the medical information provided automatically using artificial intelligence techniques that provide the beneficiary with safe medical information and health advice, to ensure that everyone enjoys better health, and in this regard, the

[1] https://wasfaty.sa , consulted on 22-05-2024, 15:50.
[2] https://wasfaty.sa , consulted on 22-05-2024, 16:00.

Sehha application has achieved record numbers of medical consultations since the beginning of the pandemic (Covid 19) [1]

Purpose of Sehha:

"Sehha" is an application introduced for unselfish humanistic and trustworthy services to upgrade the intercommunication between the patients and specialist doctors. It monitors an individual's medical health, facilitates direct medical consultation on mobile phones, and assists the health conclusions that patients can make about their health[2].

Sehha services:

- **Appointment booking service :**A service that allows the user to book person/ distance appointments, by selecting the health center and service, and setting the date and time od attendance, with the possibility of reviewing past and coming dates[3], cancelling or rescheduling upcoming dates, the app user can add the appointment in the mobile calendar **.**
- **Instant medical consultation service:** it is a service that allows the user to obtain an immediate (remote) consultation through doctors approved by the ministry of health
- **Add dependants service:** a service that allows the user to add dependents (son daughter, mother, father, husband, wife) to follow up on their health conditions **.**
- **Protection and infection control service for Corona (Covid-19):** a service that aims to help users during the (covid-19) pandemic period, by reviewing educational and awareness content.
- **Pregnancy follow-up service for women:** pregnancy follow-up service for women health electronic services serve women and children, facilitate health follow-up procedures and provide.
- **Vaccination follow-up service:** a service that allows the user to follow up on his vaccinations
- **Reviewing medical reports and sick leaves:** a service that allows the user to review the medical reports (sick leaves) of himself and of his dependents**.**
- **Medical team selection service (my doctor):** a service that allows the user to choose his medical team, book appointments with his specified team**.**

[1] Serai Oumessaad, Hadjab Nadjat, op.cit, (pp 726-727).
[2] https://www.expatsinsaudia.com/sehha-application/Consulted on 22/05/2024 at 17:00.

[3] https://www.moh.gov.sa/en/eServices/cards/Pages/default.aspx, consulted on 22/05/2024 at 17:15.

- **Insurance approval follow-up service:** a service that allows the user to follow up on the insurance approvals associated with the naphies system.
- **Medicines and prescriptions review service:** a service that allows to access medical prescriptions described to him, review to their details, and medicines that has been added manually[1]

3.2 Rasd application

Definition:

It is an electronic drug tracking application, launched to ensure the availability of essential drugs in the local market, and to ensure their safety and security, through the Food and Drug Authority, with the aim of electronically tracking pharmaceutical products at all stages from production to consumption, by adopting the latest means Technology and its use, which thus aims to combat drug fraud and achieve drug security and availability[2].

The Saudi Food & Drug Authority initiated Drug Track and Trace System for pharmaceutical products (RSD) as one of its plans to contribute in achieving the kingdom's Vision 2030 by adopting new technologies for tracking all human drugs manufactured in Saudi Arabia and imported from abroad. Drug Track and Trace enhances Saudi Food & Drug Authority's role in protecting society and guaranteeing the safety of all drugs by knowing their origin starting from manufacturing phase until consumption[3]

Objectives of Rasd application

Preventing counterfeit drugs

- Monitoring the full supply chain operations .
- Guaranteeing that all sold or consumed drugs are genuine .
- Reliable statistics about targeted medication for counterfeit.

[1] https://www.moh.gov.sa/en/eServices/cards/Pages/default.aspx, consulted on 22/05/2024 at 17:30
[2] Serai Oumessaad, Hadjab Nadjat, op.cit, (p 726).
[3] https://rsd.sfda.gov.sa/index-en.html Consulted on 23/05/2024 at 14:52.

Drug availability

- Decrease the time consumed to provide reliable data .
- Easy platform for patient to know medication information via smartphones.
- Support for the best use of the products and reduce waste.

Achieving drug safety

- Real time stop of recalled medications or with warnings .
- Enabling the consumer to check safety of a drug and report any side effects[1].

[1] https://rsd.sfda.gov.sa/index-en.html Consulted on 23/05/2024 at 15:30.

Conclusion:

By improving accessibility, efficiency, and care quality, digital health applications in Saudi Arabia have drastically changed the country's healthcare system as well as the community at large. Better patient care, monitoring of chronic illnesses, and remote consultations have all been made possible by these technologies, which have enhanced patient outcomes. Saudi Arabia's Vision 2030, which aims to modernise the healthcare system and guarantee sustainable, patient-centered care, is in line with the integration of digital health technologies. Digital health applications are promoting a more informed and health-conscious society by relieving the strain on traditional healthcare facilities and enabling individuals to take charge of their own health. This will ultimately result in a healthier population and a more robust healthcare infrastructure.

CONCLUSION

Conclusion

From this thesis we can say that the rapid evolution of the business landscape has compelled organizations to swiftly gather and process information. Embracing digitization and digital transformation is crucial for achieving greater efficiency and superior outcomes with reduced effort and cost. This trend is particularly prominent in the healthcare sector, where electronic programs and applications have markedly enhanced the quality of health services. These digital solutions facilitate easy and convenient appointment bookings, modifications, and cancellations, along with providing remote diagnosis and medical consultations.

In Saudi Arabia, the health sector's digital transformation has been propelled by the introduction of several electronic applications, such as "Wasfaty," "Rasd," "Sehha," These advancements have led to the enhancement of healthcare services and infrastructure.

Study results:

Our study has reached a set of theoretical and applied results , which we summarized as follows

Theoretical results:

- Digital health refers to the use of information and communication technologies to manage and deliver health care services .
- Digital health promotes healthcare accessibility, efficiency, and personalisation, resulting in improved patient outcomes and more efficient medical procedures.
- Digital health applications are specific software tools and platforms within this broader field.
- Top digital health tools include telemedicine platforms, wearable fitness trackers, mobile health apps, electronic health records (EHR) systems, and AI-powered diagnostic tools.
- Health care services are the organized provision of medical care to individuals or communities, including prevention, diagnosis, treatment, and management of illness and injury.
- Digital health promotes healthcare accessibility, efficiency, and personalisation, resulting in improved patient outcomes and more efficient medical procedures.

Applied results:

Verification of the hypothesis:

- The Kingdom of Saudi Arabia has launched several electronic successful applications to advance healthcare services .

- Digital health applications provide patients with easy access to medical services, including booking appointments, receiving remote consultations, and accessing medical records.
- Digital health applications empower patients to take an active role in managing their health by providing tools for monitoring and tracking health metrics, medication reminders, and personalized health advice.
- Saudi health institutions have significantly improved their readiness to combat the pandemic, elevated the efficiency and quality of healthcare services, and boosted the satisfaction levels of service beneficiaries.
- In Saudi Arabia, digital health applications like " Sehha"," Rasd" and Wasfaty have enhanced healthcare quality by improving access to medical services, streamlining appointment scheduling, and enabling remote patient monitoring, and this what proved the validity of the last hypothesis.
- The most important achievements of the Wasfaty application during the end of 2023 are 35.6 million electronic prescriptions, Connecting 225 hospitals and 2086 primary care centers to the system.
- Sehha is an application to provide innovative and sustainable solutions, keep pace with digital transformation and employ artificial intelligence in the provision of medical services.
- The Rasd application aims to track pharmaceutical products electronically at all stages from production to consumption, by adopting and using the latest technological means, which has led to reducing pharmaceutical fraud and achieving pharmaceutical security and availability.

Study recommendations:

The study suggests a set of recommendations which are:

- Providing the infrastructure to use and activate the application of digital health in Algeria by providing the necessary administrative, technical, human and financial requirements.
- Issuing a legal executive regulation to organize the use of digital health in Algeria in all fields, including the health field.
- Engage stakeholders from healthcare providers in their respective specialties to ensure the effectiveness of digital health tools and their suitability in different medical areas.
- Promoting and encouraging the productivity of the sectors targeted for digital health, especially in artificial intelligence in the field of health in Algeria; developing human capacities and startups in this field.
- Governance of digital health applications and advanced technologies with a vision centered on human health without compromising religious constants.

- Introducing the most prominent government initiatives and projects related to digital health and artificial intelligence in the health sector.
- Adding specializations in digitization in general and digital health at the pre-university stage, i.e. the secondary level, according to specific in-depth courses that include the most important projects and initiatives of the latter and their service to health, with an outlook for the future in this field.
- Directing scientific research in research centers in Algerian universities and beyond and motivating researchers to research in the field of digital health to develop applications that contribute to improving the quality of health care services.
- Sensitizing the user and the patient to the importance of using digital health applications, especially artificial intelligence in examination and diagnosis.
- Striving to attract funders of research chairs in Algerian universities in the field of health and artificial intelligence, while ensuring diversity in sub-specialties.

Study prospects:

There is no doubt that despite the effort exerted in completing this research, the latter is not without shortcomings due to our inability to address all aspects of the topic in detail, but this research can be a bridge between previous research, adding some new developments to it, to enrich and resurrect it, and future research as a prelude to topics that can be the subject of other research, including:

- Digitalization and sustainable health in Algeria.
- The role of digital health in realizing sustainable development in Algeria.
- The future of digital transformation in the health sector in Algeria.
- Artificial intelligence and the sustainability of healthcare services.
- Entrepreneurship in the field of telehealth in light of the spread of epidemics and crises.
- Electronic health records and the challenges of digital transformation in the field of health care in Algeria.

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