

Exploring Opportunities and Challenges in E-Health Adoption in Libya

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Abstract

The aim of this mixed method study was to explore the opportunities and challenges facing e-health adoption in Libya, and to uncover strategies to facilitate the adoption of this technology by studying four health institutions and obtaining the insider expertise of service providers. Using a case study approach, this study aimed to understand the opportunities and challenges facing the adoption of health information technology, with an emphasis on electronic health records, in these institutions. The data collection methods consisted of 16 in-depth interviews, 160 individual questionnaire sheets, and official documentation related to the Libyan health sector. The research was guided by the unified theory of acceptance and use of technology to help explain service providers' behavior regarding the use of health information technology. The general findings uncovered the following six themes: (1) critical issues related to vulnerabilities in technological infrastructure, (2) cybersecurity-related risks, (3) resistance to change, (4) training and awareness problems of healthcare professionals, (5) financial constraints, and (6) the absence of a comprehensive legal framework. Meanwhile, advanced analytics found that successful adoption of eHealth solutions in Libya could significantly improve healthcare delivery, reduce medical errors, enhance economic efficiency, and improve patient care. The study contributes valuable research knowledge by identifying challenges and strategies that could help in the successful implementation of electronic health records. The results suggest the need for future economic research to address workforce issues in order to improve the overall quality of health services, as well as point the way to other relevant topics for future study.

Keywords: e-health solution, EHRs, opportunities, challenges, Libyan health sector, technology acceptance model.

Dedication

I dedicate this thesis to my beloved parents, who have supported, encouraged, and prayed for me throughout my academic journey.

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Chapter One: Introduction

1.1 Introduction

Health economics focuses on the efficient allocation of resources that can lead to health maximization and promote equal access to health care services. It examines how scarce resources like labor, technology, and capital are used in the health sector for improving the health systems. According to Getzen (2013), health economics is relevant for promoting healthy behaviors and desired health outcomes through the assessment and evaluation of health care providers, hospitals, clinics and public health programs. As a useful adjunct to this field, Information and Communications Technology (ICT) has emerged as a transformational element in health economics to encourage cost control and improvements in health service quality.

In the health sector, ICT is considered a central productive element in gaining efficiency and accessibility while simultaneously improving health outcomes. As part of this technology, E-health, a term coined in the late 1990s, includes an extensive range of electronic devices and applications to improve the delivery of health services (Wilson et al., 2014). Such applications include electronic health records, pharmacy and laboratory management systems, telemedicine platforms, and patient monitoring technologies (Melinda et al., 2011). Through its role in facilitating the seamless exchange of health information among various stakeholders, including healthcare providers, pharmacies, and laboratories, ICT significantly reduces inefficiencies in service delivery, enhances patient outcomes, and smooths administrative processes.

Investment in ICT integration into health care systems is strategic and highly valuable for health economics. It guarantees efficiency, reduces duplication of tests, minimizes medical errors, and allows for remote diagnoses and treatments. As well, ICT bridges gaps in health care access, especially for underserved populations living in remote or rural areas, by overcoming the

traditional barriers of distance and time (WHO, 2010). This means that the role of ICT in health economics goes beyond just cost considerations, into improvements in equity and quality relating to health care delivery (Carolina & Marroquin, 2011).

1.2 Statement of Problem

Information and Communications Technology (ICT) is the most fastest growing technology sector in the world, and it plays a major role in economic sectors, including the areas of finance, service, and production (Akadiri et al., 2009). Healthcare is one sector that has also been affected by this technology. The term “e-health,” which is short for “electronic healthcare,” first surfaced in the late 1990s (Wilson et al., 2014), and according to Gartrell et al. (2015), it denotes “the use of emerging information and communication technology, especially the Internet, to improve or enable health and health care” (p. 280). Therefore, all tools that rely on the use of information technology to enhance healthcare fall under the term “electronic healthcare.” This can cover a wide range of applications, including electronic health record systems, pharmacy management, clinical-administrative management, medical imaging, health information management, telemedicine services, and distance learning programming in the field of health education (Melinda et al., 2011).

Using ICT in the healthcare field provides the opportunity to raise the standards, security, and effectiveness of medical care (Alotaibi & Federico, 2017). The quality of treatment can be improved by enhancing the ability of doctors, nurses, clinical technicians, and others to easily obtain and use the appropriate patient information (Ben-Assuli et al., 2017), as healthcare practitioners can electronically gather, store, retrieve, and transfer information thanks to ICT (Snyder et al., 2011). By removing the barriers of distance and time between patients and healthcare professionals, e-health apps can benefit populations that have historically been

underserved, such as those in distant or rural locations with few health facilities and staff (World Health Organization [WHO], 2010). Information and communications technology offers tremendous opportunities to improve the efficiency and quality of healthcare services for people around the world (Carolina & Marroquin, 2011). Moreover, the development of e-health has numerous implications for planning and managing health services and systems, as well as for prevention, diagnosis, treatment, and patient monitoring. In developed countries, significant progress in these areas has been recorded in recent years as a result of the use of e-health applications (Carnicer et al., 2012).

Electronic health records (EHRs) are among the most important e-health applications, as they make it possible to exchange health information between various stakeholders, including health institutions, pharmacies, and laboratories, which saves time, effort, and money (Gulavani & Kulkarni, 2010). Indeed, physicians and healthcare specialists are now able to diagnose and provide advice for the treatment of patients at a distance. The use of this technology also allows the updating of medical data or expert advice from other medical professionals to leverage the diagnosis and treatment of patients, which increases the efficiency of health services (Grunwell, 2017).

Despite all these benefits, many developing countries have not adopted EHRs in their health systems or have failed in the adoption process. This can be due either to a lack of sufficient information about the benefits that can be achieved through the adoption of e-health, or because they do not have a clear plan or mechanism in place for how to overcome the barriers they may face (Brieux et al., 2015). Studies have shown that these barriers differ from one country to another according to the economic situation, social structure, etc., but in general, they

involve lack of skills, financing, or technological infrastructure, or because of technology resistance (Hayajneh & Zaghloul, 2012).

The health sector in Libya received great attention through the economic and social development plans the country witnessed in the 1970s and 1980s (WHO et al., 2017). Numerous health institutions were built, such as hospitals, healthcare centers, laboratories, pharmacies, etc., in various Libyan cities and villages to provide healthcare to all citizens (WHO et al., 2017). Also, laws were put in place that affirmed the right of all citizens to access health services. For example, Public Health Law No. 106 of 1973 stipulates that: "health is a legitimate right for all people, and the state guarantees it for them" (p. 190). The law also stated that health services were to be provided at no cost and that the Libyan Ministry of Health was responsible for managing and supervising this sector.

As a result of the development efforts, the sector achieved satisfactory results in primary health care, as evidenced by improvements in some health indicators. The average life span, for example, increased from 46 years in 1960 to 73 years in 2000 (Kumar & Arteimi, 2010). The sector also made significant progress in the field of childhood vaccinations, particularly against diseases prevalent at the time. According to the WHO et al. (2017), the percentage of children aged under 5 years who were immunized against measles and tuberculosis up until 1999 was 92% and 97%, respectively. There was also a significant decrease in infant mortality, from 16% in the early 1970s to around 2% in 2000 (Ahwidy & Pemberton, 2016).

On the other hand, a decline in health services and a failure to manage this sector began to appear during the 1990s, which prompted citizens to seek treatment in the private sector and abroad, either at the expense of the community or at their own expense, which increased the burdens of citizens (Elfituri et al., 2006). Kumar and Arteimi (2009) state that:

... some of the reasons identified behind these major problems are challenges like lack of Human Resource Planning, Production and Management, Absence of a National Health Information System, inadequate use of Information and Communication Technology for Healthcare, lack of Management and Accountability, Poor Coordination in National Institutions. (p. 34)

The Libyan revolution of 2011 and the armed clashes it witnessed led to an increase in the demand for health services (El Oakley et al., 2013), and due to the strife, many problems emerged, which increased people's suffering. According to the WHO (2021), the conflict caused damage to 37% of health facilities, some of which ceased operations altogether. In addition to severe shortages of medication, medical supplies, and medical staff, coordination problems and other factors imposed by the war led to an almost complete collapse of the health system (Saieh, 2021; WHO, 2021). The instability that the country witnessed after the 2011 revolution did not allow a clear plan to be set up for the development of this sector, but rather, successive governments have aimed to restart this sector by maintaining or rebuilding damaged facilities and providing medicines and medical equipment (WHO, 2021).

Libya, as a developing country, has not yet adopted e-health in its health system (Ahwidy & Pemberton, 2016; Nakkas et al., 2015). The health sector in this North African country suffers from many problems that have led to inadequate health services, high costs, and other associated problems, which intensified after the 2011 revolution (El Oakley et al., 2013). This increases the need to develop this sector at the present time. One of the most important solutions that can lead to improvement in the level of health services in Libya is the adoption of electronic health records.

Despite the benefits brought by the use of information technology in various sectors, it is accompanied by many challenges, the most important of which are related to the human element, technological infrastructure, and financing (Alsadan et al., 2015). Exploring these challenges before the adoption process and proposing appropriate solutions to address them is the first step towards the success of this process (Liang et al., 2018).

The human element is the key to the success of using this technology, and studying the factors that affect people's behavior around accepting it is the first step towards the success of using the technology on a large scale (Hasanain et al., 2015). The emergence and spread of information technology has been accompanied by a phenomenon called technology resistance, which is associated with the human element (Richard & Ben-Tzion, 2010). Several theories have been established to study and address this phenomenon, based on identifying the reasons behind humans' rejection or resistance to use of new technology by studying people's behavior and thus developing appropriate solutions to ensure the acceptance and use of this technology. Some of these theories are the Theory of Planned Behavior (TPB), the Decomposed Theory of Planned Behavior (DTPB), the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology, etc. (Momani et al., 2017).

Liang et al. (2018) mentioned that effective management and the provision of appropriate infrastructure such as Internet services, hardware, equipment, software, and information protection systems, as well as the enactment of laws and legislation regulating the exchange of electronic information, are among the challenges facing the e-health adoption process.

Abdullrahim and De Coster (2016) defined this as the requirements or the level of readiness, and it represents the second component in the success of the adoption process.

Necessary financing represents the other part, which often depends on the economic situation of the state to allocate sufficient amounts to finance the project according to the phases of the plan. Arak and Wójcik (2017) indicated in their study on electronic health in European Union countries that funding is usually provided from the state's general budget for the benefit of the health sector or the entity responsible for the project. By examining the financial commitments made by some nations to such projects, it is possible to get a sense of the required amount of funding, which is useful information for the adoption plan's success (Arak & Wójcik, 2017). In contrast, lack of funding and disregard for this factor in many countries, especially those with low or middle incomes, have caused difficulties or failure in implementing electronic health records as a result of the projects' long-term fragmentation which have led to significant delays in implementation and failure to reap the projects' anticipated benefits (Liang et al., 2018).

1.3 Research Purpose

The purpose of this qualitative research is to explore the potential benefits and opportunities of adopting electronic health records within Libyan health institutions, as well as the challenges that this process may face and how to address them. In general, the research aims to gather knowledge that helps develop a vision for the adoption of electronic records within Libyan health institutions, and accordingly, this research has three main objectives, as follows:

The first objective is to gather knowledge to inform a conceptual framework of e-health in Libya through a study and review of the main concepts of e-health, the experiences of selected countries, and the policies they have used. It also explores the opportunities obtained through health applications that rely on information communications technology, and how these applications may be appropriate in the case of Libya.

The second objective is to investigate the current situation with the healthcare sector in Libya in order to highlight the problems it suffers from and how electronic health records can contribute to solving them. This requires studying several aspects, namely: (1) the structure and capacity of the workforce, as well as the technical infrastructure; (2) the role of both public and private sectors; (3) the geographical distribution of the health institutions (hospitals, clinics, and sanatoriums) and their carrying capacity; and (4) the government's expenditures for the health sector.

The third objective is to explore the challenges that affect the process of adopting electronic health records in Libyan health institutions that relate to the human element, technological infrastructure, and other factors. This will involve: (1) studying the behavior of workers in targeted Libyan health units regarding the acceptance and use of electronic health records, and identifying the factors that affect this process using the Unified Theory of Acceptance and Use of Technology; (2) finding out the extent to which the necessary information technology skills are available to supervise the operation of EHRs and train workers on them in hospitals; (3) exploring the availability of laws and legislation regulating e-health work in Libya that can be relied upon to regulate the use of EHRs; (4) evaluating the availability of funding for hospitals and the ability to spend it on development and training projects; and (5) investigating the adequacy of technological infrastructure for running EHRs, such as the Internet, internal networks, computers and peripherals, and the capacity to store and safeguard data.

The study is conducted at four public health institutions within the scope of the city of Tripoli, which are: the Tripoli Medical Center (educational hospital), Tripoli Central Hospital, National Heart Center (Tajoura), and Khadra Hospital. A mixed method case study design is used, and the Unified Theory of Acceptance and Use of Technology (UTAUT) is applied to

explore the factors involved when using EHRs in Libyan health institutions. The UTAUT was chosen because it integrates multiple key models of technology adoption, providing a comprehensive framework for understanding the behavioral intention to use a given technology. Compared to other models, such as the Technology Acceptance Model (TAM), the UTAUT incorporates additional factors, including social influence and facilitating conditions, making it more suited for the complex organizational and cultural contexts found in Libyan healthcare institutions. Questionnaires and interviews are the sources for primary data collection from the targeted health units, as they will provide information related to the study of the behavior of workers within these health institutions regarding the use of electronic health records, as well as for technological infrastructure, financial resources, and other relevant aspects. Documents such as health sector and administrative oversight reports will be used as secondary data sources to help collect information related to the performance of the health sector, including statistics, bulletins, and Audit Bureau reports about the sector and its problems.

1.4 Research Questions

Based on the objectives stated above, three research questions were formulated:

- 1- How do EHRs improve the quality of healthcare services in Libya?
- 2- What are the challenges to the adoption of EHRs in Libya?
- 3- What strategies are available to leverage the adoption of EHRs in Libya?

1.5 Research Importance

This research is important because it relates to the use and adoption of ICT in the health sector, since a primary imperative for humanity is the importance of health services for all countries, especially developing ones with poor healthcare, and health information systems are

proven to be an effective tool to improve the quality of healthcare services. This study will therefore enrich the practical and scientific knowledge in this research field.

The importance of this research for stakeholders comes from the information that will be provided, which targets providers, patients, and officials in this sector. It contributes to the growing body of research on the challenges and opportunities of implementing ICT in healthcare systems (Khalil & Al-Bousify, 2008; Melas et al., 2011). This research also contributes practical insights to inform decision-making concerning the effective use of EHRs within the Libyan healthcare system.

All responsible governments seek to improve the level of health services for their people, and they usually look for effective ways and means to achieve this goal (Pietro & Francetic, 2017). The research has great importance to Libya, especially in the currently unstable circumstances which have existed since the 2011 revolution, which have led to an increase in the demand for health services, thereby exacerbating the problems this sector faces and leading to its deterioration (El Oakley et al., 2013). The research may also be applicable to other developing countries in similar situations.

1.6 E-health Definition

There is no uniform definition of electronic health in the literature. For example, Le Pape et al. (2017, p. 56) defined it as "the use of information and communication technologies to support the delivery of healthcare services to the public," while Gartrell et al., (2015) defined the concept as "the use of emerging information and communication technology, especially the Internet, to improve or enable health and healthcare" (p. 3). The concept was also defined by Nakkas et al. (2015) as "the use of the Internet and other ICTs to support healthcare delivery to the public" (p. 1). According to the official website of the Health Canada (2010), e-health is "an

overarching term used today to describe the application of information and communication technologies in the health sector," while Khalil and Jones (2007) defined e-health as "using the computer-based technologies in the health profession practice" (p. 1). Arguably, all definitions refer to the same meaning, namely, the use of ICT in enhancing health services through the use of the Internet, while the tools that rely on information technology fall under the term "electronic health applications." The most widely used e-health tools include electronic health records and telemedicine. This study adopted this broad definition of e-health, focusing on the application of ICT in improving healthcare services.

1.7 E-Health Applications

The literature has addressed many e-health applications, but the focus here will be on the most important and most widespread, such as the Electronic Medical Records (EMRs) and Electronic Health Records (EHRs), as they are representative of the cornerstones of e-health (Auditor General of British Columbia, 2010).

Electronic Medical Records (EMRs) were the first electronic methods used to digitize patient health information (McMullen et al., 2014). This technology grew in popularity thanks to the benefits it brought over paper charts, including the ability to easily and efficiently collate and track all patient health information such as medications, prescription issuance, and laboratory results. It also helps in determining which patients are due for physical exams, vaccinations, or other procedures. For instance, in South Korea, one of the countries that used the term "EMR" to define an electronic record system within most hospitals, old medical records have been scanned to share the information with all national hospitals and public healthcare facilities, whereas previously they could only easily share data within one branch of the hospital (Knox et al., 2015). Over time, these records have been developed and become known as electronic health

records (EHRs), which term is now widely used (McMullen et al., 2014). It can be said that electronic health records are the extension of electronic medical records, which justifies the terms' interchangeable use.

Electronic Health Records (EHRs) perform all the functions of EMRs, but with some important added elements. According to Menachemi and Collum (2011), an EHR is “a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting” (p. 48). This system includes a patient’s demographic information, past medical history, progress notes, medications, laboratory data, immunizations, vital signs, radiology reports, and other health information (Menachemi and Collum, 2011). EHRs are specifically designed for sharing health information between different healthcare institutions in an integrated electronic system, and can connect medical laboratories, pharmacies (electronic prescriptions), various medical units (hospitals, primary care clinics, etc.) and health ministries (Heart et al., 2017). Studies have shown that many countries have successfully adopted long-form electronic health records, such as the USA, Canada, Australia, and some European and Asian countries (Stone, 2014). In advanced forms of EHR implementation, patients can log into their own records, read and track test results, communicate with providers, and implement changes that ultimately improve their health. This application is called a Personal Health Record (PHR), or My Health Record in some countries such as Canada and Australia.

Patient Health Records (PHRs) are a sub-system of patients’ comprehensive organizational EHR systems that can be viewed within a patient portal. Patient health records are essentially electronic medical charts that are drafted by patients themselves which contain medical data and information about the patient, and patients can access their PHRs online and view test outcomes, prescriptions, medications, etc. These medical records can be managed by

the individuals by adding new medical history, symptoms, or personal information. The PHR is designed to alleviate burdens in illness by providing access to information and allowing patients to monitor their health statuses (Caligtan & Dykes, 2011).

Telemedicine (TM), one of the applications that helps different geographical regions access health services, is defined as “the use of ICT to provide and support health care services when distance separates the participants” (Abdullrahim & De Coster, 2016, p. 1). Telemedicine is an e-health application that depends on IT. It makes healthcare access easier, especially for people in rural areas and patients with chronic diseases. It also helps educate the patient and the health care provider. Previously, the definition of TM would comprise simple telephone calls between two physicians or a physician and a patient, but the term is now applied to more complicated specialized systems, such as real-time interactive multipoint video conferencing using applications like Picture Archival and Communication Systems (PACS), Tele-DiCom technology, etc. This technology also includes e-mail systems, one of the tools of the asynchronous or store-and-forward system, where information is captured and stored on one side and then electronically forwarded to another party (Khalil & Jones, 2007). In synchronous or real-time systems, and in the ideal case via the Telemedical language, both the physician and the patient can have a direct conversation by a video conference.

1.8 Structure of Research

This study is structured as follows. Chapter 1 provides the introduction to the issues under examination, while Chapter 2 covers literature that is relevant to the topic. Meanwhile, Chapter 3 supplies the methodology behind the study, and Chapter 4 provides a detailed look at the Libyan healthcare system. Chapter 5 offers an analysis of the data gathered while Chapter 6 presents the findings, and lastly, Chapter 7 presents the conclusion to the study.

Chapter Two: Literature Review

2.1 E-Health in North African Countries

This literature review aims to identify the effectiveness level of using ICTs in the healthcare sector in Libya and selected other North African countries in order to determine the prospects of e-health in this region, which includes Tunisia, Egypt, and Morocco. It also aims to identify the most important barriers that faced these countries in using these technologies in their health systems. The second part of this review focuses on the theoretical framework, which contains certain e-health applications and theories that address the challenges and possibilities that this technology may offer.

2.1.1 E-Health in Libya

Ahwidy and Pemberton (2016) conducted a qualitative study based on questionnaires and group interviews in order to collect data about the extent of availability of ICT in urban and rural healthcare institutions in Libya and found that the use of ICT in both rural and urban healthcare facilities in Libya was insufficient for the adoption of e-health applications. The study used an E-health maturity model developed by Wetering and Batenburg (2008), with the model being divided into four stages, named presence, interaction, transaction, and transformation, to illustrate what the interoperable infrastructure looks like from a technical point of view (Wetering & Batenburg, 2008).

In Stage One of the model by Wetering and Batenburg (2008), the presence (or information) stage, non-interactive websites that are intended to spread information are created, while in Stage Two, the interaction stage, more advanced services than those available during the presence phase are provided. Here, the ability to search for and communicate with other healthcare professionals, participate in online case discussions, and submit comments and

requests is made possible by the larger amounts of information (Wetering & Batenburg, 2008). Meanwhile, Stage Three, the transaction phase, focuses on creating online service access routes to enable the completion of activities electronically. These services may include scheduling, obtaining clinical data, updating and keeping patient records, making test orders and referrals, and process streamlining, and the removal of mistakes caused by manually input data can be accomplished through integration with other systems (Wetering & Batenburg, 2008). Finally, in Stage Four, the transformation phase, institution operations and processes are streamlined and redesigned to better use the increased delivery capabilities. The biggest benefits from this phase are new types of services that are organized, effective, and connected and are made to suit the preferences and needs of the end user, rather than expecting the user to adapt to different operating systems in different healthcare institutions. The foundation created during the transaction phase is utilized throughout the implementation of the transformation phase (Wetering & Batenburg, 2008).

The results of the study by Ahwidy and Pemberton (2016) using the e-Health maturity model showed that Libya's urban healthcare institutions were at the interaction stage and its rural ones were only at the presence stage, far below the optimal fourth level. Also, the authors added that despite the existence of some ICT in Libyan healthcare institutions, the systems were not used for contacting other healthcare institutions due to a lack of equipment and skills, bad Internet connections, and occasional electrical interruptions. The study recommended that in order for Libyan health institutions to succeed in adopting e-Health protocols, significantly higher rates must be achieved on the e-Health maturity curve, which could only be achieved by providing adequate technological infrastructure (Ahwidy & Pemberton, 2016).

According to El Oakley et al. (2013), the extra demand upon the Libyan health services during and after the Libyan revolution in 2011 led to further deterioration of its health services. Indeed, the healthcare system in Libya has suffered long periods of neglect, poor funding, and lack of development programs. The authors referred to some results of the scientific conference related to the barriers facing the Libyan health sector in the use of ICT, which was held in Tripoli in 2012 under the supervision of the Ministry of Health, with the collaboration of the World Health Organization and a number of experts, in order to reorganize the Libyan health sector. El Oakley et al. (2013) summarized the barriers facing the sector in the use of information technology as including a lack of a clear national e-health strategic plan, a lack of trained health ICT staff, a shortage of the legislation necessary for underpinning healthcare information management, and no national policies or guidelines on how to collect, save, and manage health data. This was in addition to the drug legislations and regulations being considered insufficient, and that the Libyan pharmaceutical services needed urgent modernization to gain the benefits of using ICT, including much improved technological infrastructure (El Oakley et al., 2013).

In 2016, Abdullrahim and De Coster, presented a study identifying the most important factors that affect the implementation of telemedicine in Libyan health institutions, concluding that the most important of which are human resources, technological infrastructure, and user acceptance. The authors also pointed out the need to adopt e-health applications in developing countries to improve their health systems.

Nakkas et al. (2015) mentioned that the adoption of HIT in healthcare organizations in Libya has not been explored, while according to Khalil and Al-Bousify (2008) and Saleh et al. (2014), the current state of the Libyan health system is critical, as it suffers from poor coordination between administrations, funding problems, and a shortage of physicians, which has

led to a low level of medical services. Khalil and Al-Bousify (2008) added that “The implementation of electronic medical records has been discussed for a long time, yet no serious projects are being recognized” (p. 5).

According to the annual report of the World Health Organization (2021), the state of the health sector in Libya is a result of the political and security conditions the country went through and its state of instability, especially during the period from 2011 until the date of the ceasefire agreement that was signed in October 2020. These factors resulted in the fragmentation of healthcare institutions through poor governance, corruption and lack of accountability, severe shortages of medical supplies and healthcare workers, a severely disrupted primary healthcare network, and severe funding shortfalls. The report also noted that the health sector underperformed in 2021 compared to 2020, and that power, water, and fuel outages had a negative influence on people's health and ability to support themselves. Because of the uncertainty surrounding national and international participation in humanitarian and developmental healthcare programmers, both short-term and long-term developments are impeded.

2.1.2 E-Health in Tunisia

According to Trichili and Solaiman (2008), Tunisia has successfully employed telemedicine technology by linking several Tunisian hospitals to each other as well as to their counterparts in other countries. For example, Tunisia’s children’s hospital has been linked with LA Timone in Marseille, France, and Rabta hospital has been connected with Hôpital Paul-Brousse in Paris. Also, a number of Tunisian hospitals specializing in neurology, tele-pathology, and tele-radiology have been linked with hospitals in countries like Romania, Bulgaria, Italy, Australia, and Greece. Trichili and Solaiman (2008) concluded that it is essential to increase the

awareness of decision-makers at all levels about the benefits of using ICTs in health service delivery, and that there is an urgent necessity to overcome the gap between information technology and healthcare services in order to develop this sector and deliver services to all citizens, especially those living in remote areas. Further, Alsadan et al. (2015) noted the significance of this study and confirmed the success of Tunisia in this field.

Reports by the WHO (2006) and the Regional Health Systems Observatory (RHSO) (2015) pointed out that the Tunisian health information system is very weak, despite multiple attempts to develop it. Indeed, the current state of the system gives only traditional data and tools of management and does not integrate medical records of patients' healthcare or information on human resources. The WHO report adds that "There is no regulation of IT in the private sector" (WHO, 2006, p. 72). Meanwhile, the RHSO report confirmed that Tunisia has a fragmented and poorly developed health information system due to a lack of investment for the collection, analysis, dissemination, and use of data such as national health accounts and economic analyses of medical expenses (RHSO, 2015). In this regard, the RHSO report recommended that measures should be taken to overcome these deficiencies by developing electronic medical records and institutionalizing national health accounts (RHSO, 2015).

Ben Hammouda and Hadoussa (2018) pointed out that the Tunisian health sector needs to adopt EHRs in order to develop this sector, and that it is essential to explore acceptance factors for a better understanding of adoption behaviors. The authors conducted a qualitative study to determine the most important factors that may affect physicians' acceptance of this technology. A questionnaire was distributed in several Tunisian hospitals to understand healthcare professionals' attitudes and analyze their expectations. The authors postulated that the process of acceptance of EHRs is significantly determined by doctors' intentions to use them. Through

analyzing the results of the questionnaire, the study found that awareness of the ease of use and of the benefits of EHRs, as well as their facilitating conditions, were the main factors in the acceptance of ICT in the context of healthcare in Tunisia. The study also suggests that decision-makers should guarantee a favorable working environment for optimizing the use of ICT through explanations of the benefits and opportunities of using ICT for healthcare, forming a suitable technological environment, and providing a legislative and ethical framework for e-health.

According to Larbi et al. (2022), Tunisia's Ministry of ICT is leading a National Strategic Plan called "Digital Tunisia 2020," and the Ministry of Health's Information Technology Center (CIMS) is the body responsible for the digitization of the healthcare industry. However, the implementation and use of health information system (HIS) remain low, especially in health institutions, due to a lack of human resources, users' insufficient IT skills, resistance to change, and a lack of financing (Larbi et al., 2022).

2.1.3 E-Health in Morocco

According to Bennani and Elayoubi (2008), since the end of the 1990s, with the launch of the e-Morocco 2010 project, the Moroccan government has been interested in ICT as a tool to raise the level of services in various economic sectors. The government allocated 220 million euros for the period between 2006 and 2010 to provide the primary requirements of IT for various sectors, including the health sector (Bennani & Elayoubi, 2008). Public health expenditures during this period did not exceed 2% of GDP, which is considered a modest percentage compared to countries with the same population density (Semlali, 2010).

In other hand, Bouhaddou et al. (2013) stated that since 2004, the government has begun developing programs and policies to facilitate the use of e-health such as ICT training for students in health sciences at public tertiary institutions and development of continuing education

in ICT for health professionals. As well, “... a law was promulgated in 2009 to guarantee security and privacy, and it has established the fundamental rules for personal data protection” (Paquel, 2017, p. 8), and a national organization was put in place in order to set up the needed structures for e-health, such as the Moroccan Medical Informatics in 2009 and the Moroccan Society for Telemedicine and eHealth in 2011 (Paquel, 2017).

Morocco’s social, economic, and geographic characteristics have affected the development of e-health and telemedicine, and in general, communications inside the healthcare system (Semplali, 2010). The implementation of a national e-health solution in Morocco needs time, a funding plan, and skills, and important ICT investment in clinical departments is also needed to sustain activities related to the healthcare field (Bouhaddou et al., 2013).

Likewise, Le Pape et al. (2017) noted the weakness of the Moroccan health information system, stating that “Data collection is paper-based and is gleaned primarily for administrative purposes without feedback to health facilities, limited dissemination to citizens” (p. 57). The authors also pointed out that national health statistics are usually published late, and that reliable data are rarely available to policy makers. Also, the sector has not benefited from the use of information technology in electronic pharmacy services. In this regard, the authors acknowledged the importance of adopting a health management information system (HMIS) in the Moroccan health sector, and they presented a study aimed at providing Moroccan Ministry of Health leadership with recommendations for the optimal implementation of this technology (Le Pape et al., 2017).

On the other hand, Parks et al. (2019) and Fakhkhari et al. (2019) referred to the success of many University Health Centers (UHC) in Morocco in adopting electronic health records, although the existence of a number of challenges such as a lack of interoperability standards and

insufficient human and financial resources made their benefits limited (Díez et al., 2018). In fact, the functions of these applications differ from city to city. For example, the University Hospital Center (UHC) in Fez, Oujda, and Meknes are using a Spanish-language application that allows management of a patient's identity, admissions, billing, and medical records (Parks et al., 2019).

Fakhkhari et al. (2019) stated that some of the primary and secondary public hospitals in Morocco were using applications developed by the Ministry of Health, and that the functions of these applications were focused on patient identity, check in, and billing module. However, "...communication between the different databases of these hospitals is not ensured" (p. 3). On the other hand, many centers were still using the traditional paper system (Fakhkhari et al., 2019; Mounia & Habibab, 2015), and as a result of all these differences, these systems were unable to communicate, which made it difficult to have a national EHR.

Moreover, Benbrahim (2018) confirmed that Moroccan e-health initiatives are very modest and limited compared to the potential functionality of an electronic health record application. Also, the authors referred to the importance of adopting Electronic Health Records (EHRs) based on the Big Data approach in order to save on time and costs and improve the quality of health services.

While Elhadi et al. (2021) and El Otmani et al. (2021) indicated that the COVID-19 pandemic compelled governments around the world to act quickly to combat the epidemic, one of these measures included the use of electronic health solutions, including electronic platforms to track the epidemic's scope, areas of spread, percentages, locations where vaccines were distributed, and other information to aid in resolving the crisis. Likewise, North African countries (Libya, Egypt, Tunisia, and Morocco) are developing strategies with the help of

international organizations, especially the World Health Organization, to benefit from these platforms, and have already used them in facing the crisis (Wehbe et al., 2021).

It is important to mention that Morocco has profited from this experience by utilizing telemedicine as one of the strategies to fight this pandemic and make sure its health services are accessible to as many people as possible, particularly those with chronic conditions and rural populations. El Otmani et al. (2021) noted that a number of computerized telemedicine systems have been deployed, offering medical consultation services, appointment-scheduling, and other services. As a result, video-conducted follow-up conversations between patients and their doctors have been beneficial for many patients, especially those with chronic conditions. The National Council of the Order of Physicians (CNOM) established the first Moroccan telemedicine commission to make it easier to adopt telemedicine practices that are open to both patients and physicians (El Otmani et al., 2021).

El Otmani et al. (2021) also emphasized the importance of finalizing the legal changes and other improvements required for the best possible dissemination of telemedicine, particularly those related to the funding of telemedicine work, the definitions of rights and obligations, privacy protection, and regulation of the duties of multidisciplinary actors in the field of telemedicine. According to the Moroccan Ministry of Health (2018, May 16), the 2025 Moroccan health plan aims to use digital transformation as a mean of improving management and resource allocation. This strategy is the most comprehensive Moroccan approach to healthcare and information technology, and it aims to reorganize and develop the healthcare sector to ensure improved access to health services.

2.1.4 E-Health in Egypt

Sharaf et al. (2013) conducted a qualitative study to evaluate EHR adoption in Egypt. The survey covered 50 Egyptian hospitals, with data gathered by questionnaires that targeted three categories: doctors, nurses, and administrators. The researchers received responses from 60% of participants, and the study concluded that only 6.67% of the hospitals had adopted EHRs in their systems. However, the hospitals that adopted this technology witnessed a significant improvement in the quality of their services. Meanwhile, the barriers that prevented the adoption of this technology in other hospitals had centered around the cost, lack of computer skills or access to technical support, lack of uniform industry standards, and privacy and security concerns (Sharaf et al., 2013).

Abdelgaber et al. (2017) mentioned that the Egyptian Data Management Systems Company (DMS) had been mandated to implement EHRs and hospital administration systems in Suez Hospital, initially, as part of the new social health insurance act. Staff inserted patients' files into the system, and they were able to add or modify the information during the patients' visits. A contract was also signed between the Egyptian Insurance Organization and the Siemens Corporation to implement EHRs in the Abu Al Rish Children's Hospital as a start, and then they circulated it to the rest of the hospitals. These projects with DMS and Siemens have been halted since 2010 because of financial, administrative, and technical barriers. In 2013, the Egyptian Health Ministry reset its accreditation standards, and electronic medical record implementation in the hospitals became a condition for accreditation. However, the standards did not specify the conditions for electronic medical records, and there is a lack of details for these standards, which makes it difficult to follow them when adopting EHRs (Abdelgaber et al., 2017). Abdelgaber et al, (2017) pointed out that four hospitals had received accreditation from the Ministry, while

many others were still working on it, including by adopting electronic health records, to be members in the updated national health insurance program (Abdelgaber et al., 2017; Ahmed & Salama, 2015).

Ahmed and Salama (2015) argued that “Egypt has still a long way to go in realizing a fully integrated efficient e-health system” (p. 2), as the functions of the applications that had been implemented varied between hospitals; some of these applications did not go beyond electronically booking appointments and recording patients’ initial data, while others extended to patients’ electronic health records and other administrative and financial functions.

Hussein and Khalifa (2012) and Díez et al. (2018) pointed out the importance of telemedicine as one of the solutions to raise the level of quality of health services in Egypt, especially for those suffering from chronic diseases and those living in remote areas. However, the use of this technology faces several challenges, such as patients’ refusal to receive telemedicine health services and a lack of financial resources, professionals, capacity-building programs, and a legal framework and standards for data exchange security. Farid (2019) indicated that despite the importance of e-health in developing the Egyptian health sector, it has not been widely adopted due to financial constraints in addition to a lack of technological infrastructure and national e-health policy.

Mohamed (2020) conducted a study on the primary healthcare center in the city of Al-Omraniya, Egypt, which serves about 60,000 residents in the region, and the study focused on patients' opinions about health services, waiting times, and their satisfaction with the services. Among the findings of the study were patients' dissatisfaction with the health services provided by the center and the long waiting periods, in addition to the difficulty patients had communicating with doctors. The author also pointed out the need to adopt electronic health

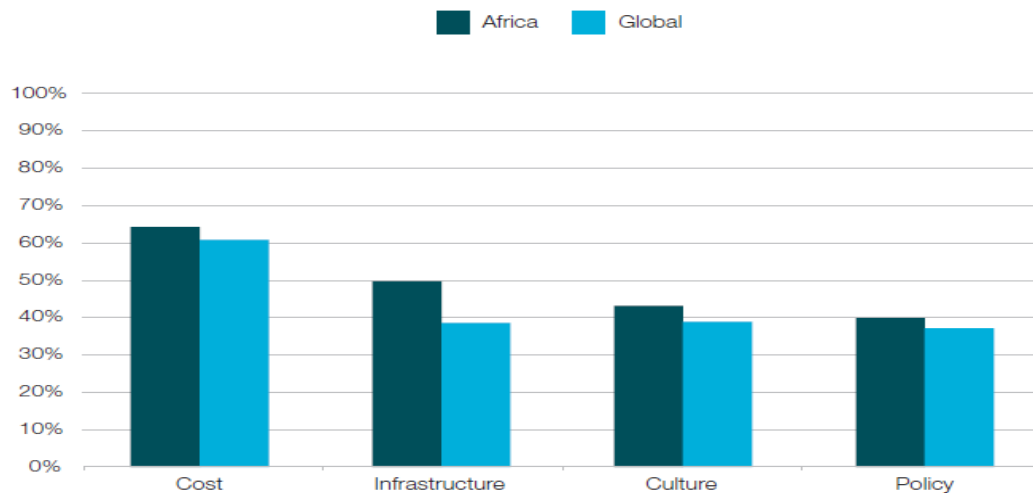
records in such centers instead of the paper system currently used in order to improve the quality of health services for these centers and reduce effort and costs, especially in light of the scarcity of medical and financial resources. Mohamed (2020) also pointed out the need to pay attention to management and to develop a mechanism for coordination among employees to ensure the success of the implementation of electronic health records.

According to Mubasher (2021), Egypt's Universal Health Insurance Authority (UHIA) has established e-Health, a new firm for the creation, administration, and operation of health technology and digital solutions, in conjunction with e-finance. This action fits under the e-finance growth strategy, which is a component of Egypt's efforts to strengthen its healthcare system that intends to provide digital transformation solutions for all Egyptian industries. Enterprise (2021) noted that Egypt's Universal Health Insurance Authority (UHIA) has launched e-Health, a company for the development, management, and operation of health technology and digital solutions, in collaboration with e-finance company, will offer complete and integrated services ranging from technical support services and consultations to managing the day-to-day operations of insurance and health technology systems. This firm is anticipated to begin operations in the first half of 2022 and provide results over the next several years (Enterprise, 2021)

Through the current review, it has been noted that the health systems in North African countries that were surveyed in general, and Libya in particular, have not benefited significantly from the advantages of e-health applications, especially electronic health records. For example, in Egypt and Morocco, the electronic records of some hospitals were implemented by different entities or companies, and sometimes in different languages, which makes linking these applications together in the future a difficult task, if not impossible. Thus, these records lose their

importance for providing and exchanging information. The investigations also revealed that the biggest challenges these nations had in implementing e-health were a lack of financing, suitable skills, and adequate technological infrastructure, in addition to limitations in the regulatory and legal frameworks for e-health.

These findings are generally in line with those of a number of scholarly investigations into the challenges that North African nations face in adopting e-health, such as those by Alsadan et al. (2015) and Díez et al. (2018). While the significance of these challenges varies from one region to another depending on the economic, social, and cultural circumstances of the region under study, most studies concur that the first barrier for medium- and low-income countries is the element of financing, which depends on what the government allocates, for example, to cover the costs of e-health projects. Other barriers, such as cultural, technological, policy, and legal, come next in importance. According to the WHO's Global Observatory for eHealth (2010), the biggest challenges for African and most other nations in accepting the use of e-health in general and telemedicine in particular were related to cost, technological infrastructure, culture, and policies, in that order, as indicated in Figure 1.

Figure 1*Greatest e-Health Challenges Facing African Countries*

Source: WHO Global Observatory for eHealth (2010, p. 72)

In this regard, it is noteworthy that most developed countries that have succeeded in adopting electronic health records such as Canada, Australia, England, and the United States, have used the principle of comprehensive planning in adopting these records (Karim & Balachandran, 2008). In these countries, they considered it a national project to cover the whole country that was put under the supervision of a specific authority, such as the Ministry of Health, with a committee monitoring the implementation of the adoption plan and working to solve the any problems during implementation. For example, in the U.S., the HITECH Act provides an incentive plan for the adoption and use of EHRs to address financial and technical barriers (Cohen, 2016), while in Canada, the Canada Health Infoway initiative was the institution created to facilitate the adoption of EHRs across the country by addressing technical and financial barriers (Registered Nurses' Association of Ontario [RNAO], 2017). Meanwhile, in Australia, HealthConnect is a national initiative to help implement e-health and ensure that relevant

information is smoothly and securely exchanged (McSherry, 2004). Such processes and administrative infrastructure reflect what North African countries were lacking when attempting to adopt electronic records in their health systems.

In the case of Libya, studies have confirmed the lack of widespread use of electronic health applications, especially electronic health records, which makes the adoption of e-health one of the most important factors in developing this sector and improving the quality of healthcare services. This research therefore seeks to bridge this gap by providing knowledge to help build an effective strategy for the adoption of electronic health records in the Libyan health sector.

2.2 Theoretical Framework

The term e-health appeared in the late 1990s, with the emergence and use of the Internet and the consequent great development in information technology (Jahanbakhsh et al., 2011). This integration led to association of the term “e”, short for “electronic,” with sectors using such technology, such as e-business, e-commerce, e-health, e-education, etc. (Wilson et al., 2014), and the related spread of health information technology (HIT) worldwide now offers tools to enhance the delivery of effective healthcare services. As a result of the development and spread of the use of this technology in the health sector, a large number of models that address the various issues (technological, socioeconomic, ethical, etc.) of this integration has emerged, with the aim of reaching advanced stages of adoption and sustainability of this technology in the health sector (Sittig & Singh, 2011). To gain a deeper understanding of electronic health and its most important aspects, besides studying and reviewing the most important applications of e-health, some relevant models or theories are here addressed to explore the technological, cultural, and socioeconomic issues arising from the use of information technology in the health sector.

2.2.1 Choice of EHRs for Libya

Through comparison between the functions of electronic health record applications and electronic medical records, as shown in Table 1, it is apparent that electronic health records (EHRs) are more appropriate for the case of Libya. The importance of this type of record lies in its ease in data-sharing and its benefits in linking various stakeholders in addition to including all the functions of electronic medical records, which makes it more useful and more practical. It can also be said that an electronic health record is an electronic platform that can be continuously improved to obtain various functions such as e-referral, e-prescribing, and e-consultation. According to Naserias et al. (2015), the referral process is defined as “transferring (including sharing) of responsibility of patient care from referring provider to another physician or provider, so that it also includes the transfer back of patient care in an appropriate time” (p. 2).

Table 1*The Most Important Features of Electronic Records.*

EHR	EMR
External use: Information sharing between different healthcare institutions and patients (Heart et al., 2017).	Internal activity: Information cannot be transferred to other healthcare institutions or to patients (limited use) (McMullen et al., 2014).
The consumer needs to open a file only once in any health institution within a state's boundaries, which helps save time, effort, and cost (Menachemi & Collum, 2011).	The consumer or patient needs to open a new file when visiting any independent health institution (McMullen et al., 2014).
-High costs because it is a national project that needs high accuracy in planning, execution, and follow-up, which is usually under the supervision of the state through agencies such as a ministry of health (Arak & Wójcik, 2017). -The plan can include all public and private health institutions of the state. -Usually, the expenditure on this project is from the state budget (percentage of GDP) (Arak & Wójcik, 2017).	-Less expensive than EHRs, as they can be implemented in separate units at different times (Knox et al., 2015). -The institution (private or public) can adopt EMRs and take responsibility for funding (Knox et al., 2015).
-In the long term, cost is often reduced due to the link between all health institutions, data-sharing, and economies of scale, resulting in higher quality health services and increased consumer satisfaction (Stroetmann et al. 2006).	-An improvement of health services at the enterprise level with a relative reduction in costs (McMullen et al., 2014).
-Through the information exchange feature, most of the characteristics of telemedicine can be obtained (Menachemi & Collum, 2011).	-Most telemedicine characteristics cannot be obtained due to the lack of data-sharing (Knox et al., 2015).
-Access to reports (health, medicine, administrative and financial) quickly and accurately, at the level of the institution or the province or state, which would be used to support the decisions (Menachemi & Collum, 2011).	-Access to reports (health, medicine, administrative and financial), quickly and accurately, at the level of the institution, which would be used to support the decisions (Knox et al., 2015).
-More complicated, this platform contains an EMR's functions, personal records, and most telemedicine functions (McMullen et al., 2014).	-Most countries that have adopted EMRs have moved or are preparing to move to EHRs to obtain their enhanced features (Stone, 2014).

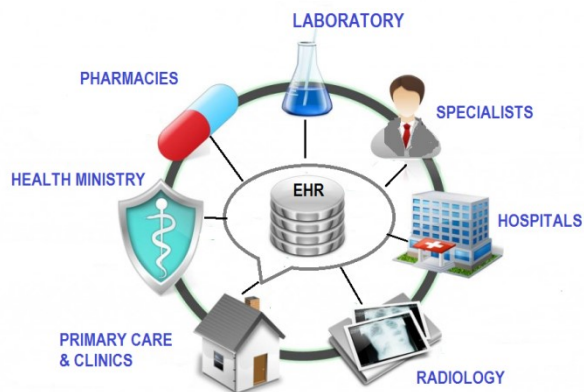
Sources: Prepared by the author.

Razi et al. (2011) explained that the main feature of EHRs is that health information can be created and managed by authorized providers in a digital format capable of being shared with other providers in different healthcare organizations, such as specialists, emergency facilities, medical imaging facilities, laboratories, pharmacies, clinics, and health education institutions,

and so it can contains information from all stakeholders involved in a patient's care, as shown in Figure 2 below.

Figure 2

Example of an EHR System



Softclinic Genx (2021).

Clare et al. (2015) stated that using this application successfully and obtaining its benefits depends on the extent of integration between the various stakeholders in the exchange of health information for patients. The most important benefit of this integration is that it enables the treating physician to obtain quick and accurate information about the patient that is useful in the diagnosis and advice process, as it reduces medical errors resulting from lack of information or handwritten prescription. It also reduces waiting time and lowers costs in the long run (Khalifeh & Gerami, 2010). There is no doubt that adopting these records in the Libyan health sector in the correct way will ultimately lead to an improvement in the quality of health services and minimize costs.

It should be noted that if the software languages of healthcare providers (such as hospitals, clinics, laboratories, radiography, etc.) are different, integration may be difficult to achieve, as it will require additional costs as a result of using intermediary programs to link these

different applications (Torre-Díez et al., 2013). Perhaps one of the most popular solutions is the Health Level Seven (HL7) program that was accredited by the American National Standards Institute (ANSI) in 1994 (Levin 2019). In the case of Libya, HL7 may not be necessary if standardized systems are used for all stakeholders when adopting the electronic health records.

2.2.2 Economic Impact of Switching to e-Health

Spending increases are among the main economic determinants of the decision to switch to e-health, especially in low- and middle-income countries. Indeed, such countries need to meet the cost of the requirements of e-health, including developing infrastructure, which should be viewed as a long-term investment (Arak & Wójcik, 2017). For the successful implementation of e-health applications, especially electronic health records, a strong information and communication technology infrastructure that can be relied upon in exchanging information in a smooth, fast, and secure manner must be in place. According to Fadlalla and Schaffer (2005), the establishment of such technological infrastructure is either the responsibility of the government or under its direct supervision, and it represents the basis on which institutions can build upon when moving towards adopting electronic business formats in various sectors. Infrastructure includes telecommunications, access to computers, Internet hosts and service providers, available bandwidth and broadband access, and a stable electrical supply. When these elements are available, individuals and institutions will have access to good-quality Internet services. Next comes the role of institutions in building their own infrastructure, which includes hardware, software, networking components, an operating system, and data storage systems such as database servers or cloud technology, all of which are used to deliver IT services and solutions (Schweitzer & Synowiec, 2012).

Through the literature review, it can be seen that many countries have faced financing difficulties either during the implementation of EHRs or in maintaining their operation. This is due to a lack of interest in analyzing the expected short-term and long-term spending and taking it into consideration when developing the plan. For example, Canada Health Infoway, an organization devoted to advancing the adoption of e-health in Canada, received a \$500 million investment from the Canadian federal government in 2010 (Canada Health Infoway, 2010), while in the United States, the Obama government pledged in 2009 to invest \$19.2 billion into healthcare IT (Steinbrook, 2009). However, it is not an easy task to design and deploy an electronic health record system. For example, in Canada, there are millions of medical contacts every day, and according to the 2009 report from the Auditor General of Canada, there are 35 million diagnostic pictures taken, 2.8 million hospitalizations, 382 million prescriptions filled, 322 million doctor visits, 440 million laboratory tests completed, and 35 million prescriptions filled annually.

The study by Arak and Wójcik (2017) on European Union countries that have adopted electronic health systems found that spending on the health sector in these countries has increased significantly as a result of the adoption of this technology. According to the study, the average amount spent on the health sector was pegged at about 5% of GDP at the time these countries began to implement healthcare information technology, and from an estimated average of 4% of GDP in 1970, this increased rapidly until it reached 9% of GDP in 2016.

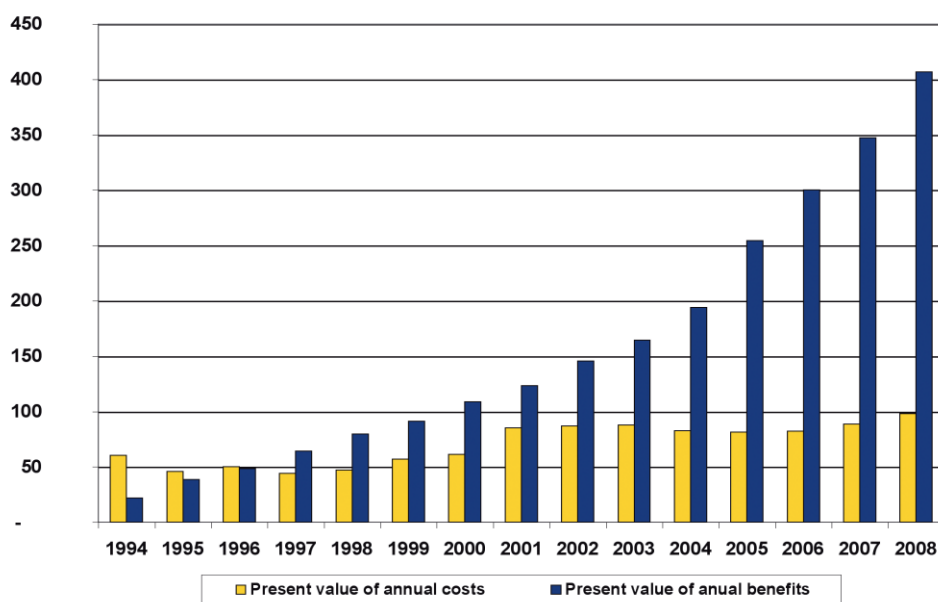
Stroetmann et al. (2006) indicated that the average proportion of gross domestic product spent on the health sector will stabilize at a particular level following the foundation phase, and that the third year of operation or the start of the transformation plan is when the health sector starts to see returns or good results as a consequence of the intense usage of information

technology. As a consequence of the growth of the electronic interchange of health information, the usage of electronic prescriptions and referrals, reductions in waiting times, etc., there is an increased quality of health services and a reduction in costs (Menachemi & Collum, 2011).

In terms of economic benefits, the study by Stroetmann et al. (2006) provided a good example of the potential economic benefits of e-health in the ten European countries included in the study. Figure 3 displays the combined data, and very effectively demonstrates the potential economic benefits of e-health. The aggregated annual value of benefits increased steadily between 1994 and 2008, rising from less than €20 million in 1994 to roughly €200 million in 2004, and an anticipated €400 million in 2008. Contrarily, as shown in Figure 3 (the yellow columns), beyond the first phases of planning and execution, the related expenses remain mostly steady and do not exceed €100 million annually.

Figure 3

Estimated Values of Annual Costs and Benefits of e-Health for a Virtual Economy of 10 countries (1994 to 2008, in € millions)



Source: Stroetmann et al. (2006)

When predicting the projected level of expenditure for the health sector, several aspects are taken into consideration, including the population, its age groups and how they are distributed, the number of health facilities, their capacity, and how they are distributed, as well as the workforce, etc. (WHO, 2010). The expansion of the use of technology in the health sector has become one of the most important determinants in estimating the volume of spending in this vital sector and must be taken into consideration when developing an adoption plan (Akca et al., 2017).

2.2.3 E-health Policy

E-health policy can be defined as “a set of statements, directives, regulations, laws, and judicial interpretations that direct and manage the life cycle of eHealth” (Khoja et al., 2012). The use of e-health inside or between institutions involves a number of elements that call for careful planning and are supported by clear policies, norms, standards, or guidelines at the institutional, jurisdictional, and international levels (Khoja et al., 2012). Inadequate implementation of these principles might result in issues with the planning for e-health that could prevent the desired goals from being met (McSherry, 2004).

The adoption of e-health applications often involves an argument about ethical issues that may arise from this process (Ozair et al., 2015). Most of the studies and ethical theories associated with the use of this technology focus on a number of rules and principles that must be taken into account when setting e-health policies, including privacy, consent, security, trust, and confidentiality.

The importance of electronic records comes from the possibility of collecting all a patient's clinical information in one access point, so that the physician can see it and come to an accurate diagnosis of the patient's condition. However, unauthorized third-party access raises a

sensitive ethical issue, which is violation of privacy (Winkelstein, 2005). Privacy is defined as “the right of individuals to keep information about themselves from being disclosed to others” (Harman et al., 2012, p. 2), and as a result of using patient information for various purposes such as scientific research, protecting privacy becomes a complex challenge (Effy et al., 2018). What contributes to this complexity is that standard protection techniques such as identity concealment, consent, etc. must be continually updated to keep pace with the rapid development of technology (Komesaroff & Kerridge, 2018). Despite the power of anonymization technologies, the risk of re-identification is possible if enough resources were to be devoted to it. Moreover, the risk of database hacks and misappropriation of data brings another challenge. For instance, according to Effy et al. (2018), “In May 2017, healthcare databases in one hundred countries faced a ransom ware attack claiming a ransom of \$300 in Bitcoin to unlock affected each machine” (p. 4). Patients have a right to privacy and to feel that their information will be safe, and healthcare institutions have the responsibility to choose programs that best protect their patients’ privacy, and physicians have a duty of confidentiality arising from the patient-physician relationship. As well, a patient's consent should be obtained before using or publishing their information.

Consent is one of the ethical issues addressed by many studies related to electronic health. In fact, a patient’s information should be released to others only with their permission or as allowed by law. According to The Canadian Medical Association, consent means “a patient’s informed and voluntary agreement to confide or permit access to or the collection, use or disclosure of his or her health information for specific purposes” (as cited in McSherry, 2004, p. 4). Express consent must be given explicitly, often orally or in writing, but due to the nature of health services, the express consent is unequivocal and does not require any inference from the

provider seeking consent (Miesperä et al., 2013). In contrast, implied consent brings a reason to believe that the individual has knowledge relevant to this agreement and would give express consent where it is needed (McSherry, 2004). The best example of implied consent is when the patient offers their arm for a blood test, but this kind of assumed consent only applies to the procedure in such situations. Another case is when patients give information about themselves to a healthcare provider, which means they also give consent to use the information for the direct provision of diagnosis and treatment (Miesperä et al., 2013). The explicit or implied consent of a patient to use their information for purposes permitted by law, such as treatment or science research, does not mean that such information is subject to publication (Harman et al., 2012). This leads us to focus on another moral principle: confidentiality and trust.

The debate about privacy and consent is surely an important one, but there are additional ethical issues that had been raised by the move to e-health systems that should also be considered, and these issues are related to confidentiality and trust (Komesaroff & Kerridge, 2018). Spriggs et al. (2012) emphasized that individuals have the right to choose their own health data that can be shared, which usually they believe will not affect their lives in any way. The authors added that this belief comes from the trust that this information will be used correctly. After this stage, the duty of confidentiality lies with the service provider. For example, an HIV patient may agree to his or her health information being used and disseminated in research studies, but not necessarily to the use of any of his or her identifying data, e.g., name, image, or address (Spriggs et al., 2012). According to Sulmasy et al. (2017), confidentiality depends on several elements, the most important of which is the prevention of unauthorized workers to access patient information, which is possible when designing electronic records. Therefore, it is necessary to take into account the limits of workers' access to information in accordance with

their specialization and needs. Harman et al. (2012) stated that: “The user’s access is based on pre-established, role-based privileges. In a physician practice, the nurse, and the receptionist, for example, have very different tasks and responsibilities; therefore, they do not have access to the same information” (p. 2).

Strong protection programs are also essential to ensure the confidentiality of patient information, which includes basic standards such as usernames and passwords which require constant changing and other protection measures. For example, “Many organizations and physician practices take a two-tier approach to authentication, adding a biometrics identifier scan, such as palm, finger, retina, or face recognition” (Spriggs et al., 2012, p. 2). In this way, users can perform their functions but are responsible for the confidentiality of the information they are authorized to access.

Trust is the fundamental basis of the patient-physician relationship. Only through trust can patients share deeply personal information with the physicians that will help their treatment process, whether the patient be a teacher, a celebrity, an employee, or a politician (Sulmasy et al., 2017). Dissemination and use of patient information without obtaining consent will be detrimental to trust in health institutions and will have legal consequences (Anderson, 2007). Building and maintaining trust is one of the challenges facing the use of e-health, given the rapid development of technology and the nature of information exchange, which sometimes makes the process of saving data problematic. Patients who deal with health institutions must be confident that their information will be safe and confidential, because if not, patients will refrain from disclosing information that may be medically important.

The following example gives an idea of the risks of privacy violation and its impact on trust in health institutions. UCLA Health is an academic medical center that comprises a number

of hospitals and an extensive primary care center in the Los Angeles region of the U.S. (UCLA, n.d). According to Harman et al. (2012), in 2011, as a result of weak protection measures, some employees of UCLA were able to access celebrities' records without proper authorization, which reflected the failure of the institution to implement security programs to establish limits for employees' access to patient information to prevent unauthorized personnel from accessing it. This situation resulted in a moral and legal issue, and to settle the privacy and security violations, UCLA Health agreed with the U.S. Department of Health and Human Services Office for Civil Rights (OCR) to provide US\$865,000 in compensation (Harman et al., as cited in OCR, 2012). As stated by Harman et al. (2012),

Confidentiality depends on several elements, the most important of which is the prevention of unauthorized workers to access patient information, that's possible when designing electronic records, it is necessary to take into account the limits of the workers' access to information in accordance with their specialization and needs. (p. 714)

Building trust between a health institution and the patient depends on taking into account all the ethical principles in the field of health, some of which have been discussed above, such as maintaining the privacy and confidentiality of patient information, which must be published only after obtaining the required consent. Moreover, it is crucial to ensure a patient's trust by saving any information that may affect them socially or psychologically. It must also be noted that the main objective of collecting and sharing information should be to serve the patient's best interest.

2.2.4 E-Health Culture

According to the WHO Global Observatory for eHealth (2010), the term "culture" refers to a change from the work style or work environment that relies on a traditional paper system, in

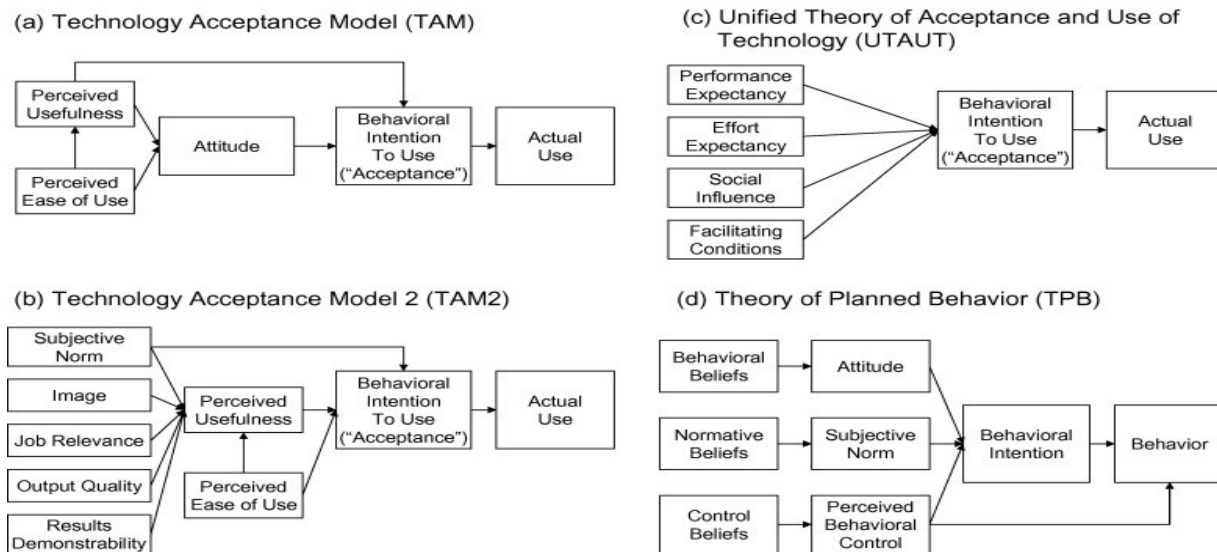
which the use of computers or electronic applications plays only a small part, to a new system that relies primarily on communication technology and information. This change is one of the main determinants of the use of information technology in the health sectors of developing countries. This has the effect of making it necessary to modify organizational cultures and work styles to fit the new information technology-based workplace (WHO, 2010). The most significant cultural issues affecting workers in the healthcare industry as a result of this transformation is the phenomenon of "technology resistance," which means resistance to the change from the current working environment to the new one (Hoque & Bao, 2015). One of the key elements for the success of implementing the use of information technology in the health sector is thoroughly researching this problem and creating appropriate solutions to avoid or lessen its occurrence by using appropriate technology acceptance models.

2.2.5 Technology Acceptance Theories

Since the beginning of the 1980s, with the widespread use of information communication technology in various fields, the phenomenon of workers' unwillingness to use new technology, called "technology resistance," has emerged (Melas., 2011). As a result, several theories about technology acceptance have attempted to address this problem by analyzing users' behavior and discovering the factors that may affect their intentions to use new technology. Figure 4 illustrates some of the most popular of these theories: Section (a) shows the Technology Acceptance Model (TAM); Section (b) shows the Extended Technology Acceptance Model (TAM2); Section (c) shows the Unified Theory of Acceptance and Use of Technology (UTAUT); and Section (d) shows the Theory of Planned Behavior (TPB) (Richard & Ben-Tzion, 2010).

Figure 4

Illustrated Example of some Technology Acceptance Models



Source: Richard and Ben-Tzion (2010)

Melas et al. (2011) stated that these theories rely on analyzing the behavior of users, based on social and behavioral theories such as Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB). Meanwhile, Momani et al (2017) mentioned that the founders of these theories also believed that knowing the factors that shape the intentions of the individual is the key that institutions can use to influence these factors to enhance acceptance and thus increase the use of information technology.

According to Ayaz and Yanartas. (2020), these theories depend on quantitative methods to determine the relationship between the variables. First, information is gathered by distributing a structured questionnaire containing pre-prepared questions that cover all the axes assumed by each theory. Then, by analyzing the results using statistical tools such as regression analysis to determine the variance and strength of the relationships between variables, the researcher can predict the extent to which the sample under study will accept the use of information technology,

as well as the factors that can affect this process. In the following, in preparation for their use in this research, the basic principles of the TAM and UTAUT theories are reviewed.

2.2.5.1 Technology Acceptance Model (TAM). Richard and Ben-Tzion (2010) noted that the technology acceptance theory (TAM) has gone through several changes. Its first version indicated three factors to explain IT acceptability, prediction, and control, as shown in Figure 4a. It posited that behavioral intention (BI) reliably predicted actual use, and that BI is influenced by one's attitude toward using IT, and that the attitude (ATT) has two determinants: perceived usefulness (PU) and perceived ease of use (PEOU). The theory also assumed that the perceived usefulness (PU) has independent effects on behavioral intention (BI) and perceived ease of use (PEOU).

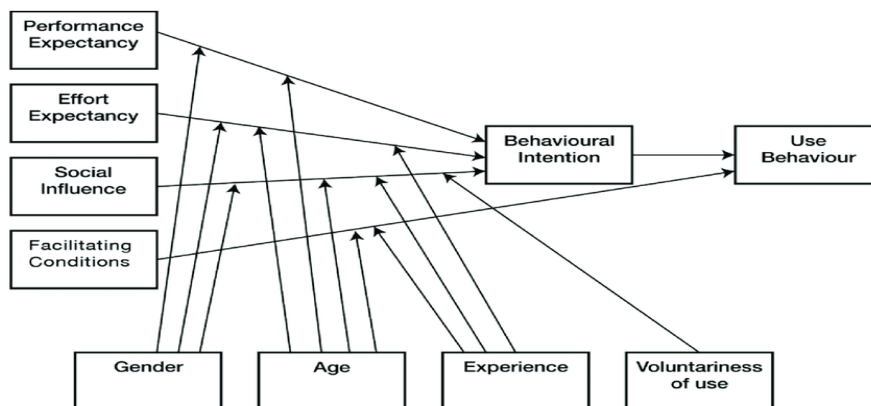
2.2.5.2 Extended Technology Acceptance Model (TAM2). The second version of this theory is called TAM2, and it was developed by Venkatesh and Davis (2000), who removed the ATT component that originally mediated some of the influences of PU and PEOU. The TAM2 theory added a new variable and aimed to capture the social influence (e.g., from colleagues or bosses), called subjective norm (SN), that makes end users positively evaluate and accept IT. According to this updated theory, the general determinants of perceived usefulness are subjective norm, image, job relevance, output quality, result demonstrability, and perceived ease of use, in addition to two moderators: experience and voluntariness (Figure 4b).

2.2.5.3 Unified Theory of Acceptance and Use of Technology (UTAUT). To formulate the unified theory of acceptance and use of technology (UTAUT), Venkatesh et al. (2003) relied on eight models, namely, the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behaviour (TPB), the combined

TAM and TPB, the model of Personal Computer Utilization, the Innovation Diffusion Theory, and the Social Cognitive Theory. According to Asastani et al. (2018), based on this model, behavioral intent (BI) depends on four factors, namely, performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). The first three (PE, EE, and SI) are direct determinants of usage intention behavior, while the fourth (FC) is a direct determinant of user behavior. Meanwhile, gender, age, experience, and voluntariness of use are assumed to moderate the impact of the four key constructs on usage intention and behavior, as seen in Figure 5. It should also be noted that there is an approach to adding new variables in line with the situation under study by testing these variables and ensuring their validity before they are approved (Richard & Ben-Tzion., 2010).

Figure 5

Unified Theory of Acceptance and Use of Technology (UTAUT)



Source: Venkatesh et al. (2003)

2.2.5.4 UTAUT Model for Analysis of Users' Behavior Regarding Acceptance of EHRs in Libya. The conceptual framework for technology acceptance models has played a pivotal role in comprehending user behavior across diverse research domains. For example, early validation tests of the Unified Theory of Acceptance and Use of Technology (UTAUT) proved it was statistically significant, and indeed that while it explained an impressive 70% of the variance in

behavioral intention (BI), in actual use it reached about 50% (Venkatesh et al., 2003). This result led to its use in several fields, especially in the health sector, to explain end-users' behavior and reactions toward the use of new technology (Dwivedi et al., 2011).

Below, the results of key studies that relied on this theory uncover important factors affecting employees' behavior in accepting and using technology. For example, Afonso et al. (2012) found that performance expectation was the most influential factor in influencing employees' behavioral intentions, while there was no effect from effort expectation. They also found that social influence, represented by the influence of peers and social media, has an impact on the behavioral intention of users towards using an electronic document management system (EDMS). In the same context, by using a model that combined the UTAUT and TAM theories, Kim et al. (2016) conducted a study to evaluate the factors influencing employees' intention to use portable EHRs. The study's results revealed that performance expectancy and attitudes significantly influenced end users' intention to use these mobile records, and therefore the study recommended using these two factors as tools that aid acceptance. Likewise, Donmez Turan (2019) suggested that adopting the four basic elements of the UTAUT model in general can help users develop a positive attitude towards accepting the use of a new system. Thus, he argues, if individuals have a positive view of the system which supports their performance expectations and efforts, then facilitation and social influence will have an increased impact on individuals' intention to use technology.

Furthermore, statistical results can be used to better express the relationship between variables. In another significant contribution, Al-Adwan and Berger (2015) harnessed the UTAUT to discern doctors' behavioral intentions regarding the adoption of electronic health records in Jordan. The meticulous study unveiled compelling outcomes, with all relationships

proving statistically significant at the 1% level ($p < 0.01$). The four independent constructs Perceived Usefulness (PU), Perceived Threat (PTH), Perceived Ease of Use (PEOU), and Social Influence (SI) directly influenced Behavioral Intention (BEI). Meanwhile, Social Influence, Perceived Ease of Use, and Perceived Usefulness emerged as facilitators for EHR adoption, with Social Influence exerting the most substantial direct effect on BEI (Beta = 0.33). Additionally, Perceived Ease of Use positively influenced intentions (Beta = 0.28), suggesting its association with favorable inclinations toward EHR adoption. Similarly, Perceived Usefulness positively influenced physicians' intentions (Beta = 0.21). In contrast, Perception of Threat emerged as the solitary inhibitor, negatively impacting Behavioral Intention (Beta = -0.29). These results underscore the intricate interplay of psychological and social factors in shaping physicians' behavioral intentions.

In a pioneering study conducted by Idoga et al. (2018), the acceptance landscape of cloud-based health information systems among patients and healthcare providers in rural Nigeria was explored. Expanding upon the UTAUT model, the study unearthed multifaceted insights, with standardized coefficients illuminating the relative impact of various factors. Particularly noteworthy was the prominence of Performance Expectancy, which boasted the highest Beta value at 0.31, pointing to its significant influence on professionals' intentions to adopt cloud-based systems. Furthermore, Effort Expectancy exhibited a substantial positive relationship (Beta = 0.19), signifying the importance of system usability. Social Influence emerged as a pivotal element, featuring a Beta value of 0.21 and emphasizing the intricate interpersonal dynamics shaping adoption decisions. Interestingly, cloud-based health knowledge failed to attain statistical significance (Beta = 0.09, $t = 1.49$).

A subsequent exploration by Hossain et al. (2019) set out to identify factors influencing physicians' adoption of electronic health records (EHRs) in the public and private health sectors in Bangladesh. In that study, Hossain et al. employed UTAUT and distributed a questionnaire to their study sample of 300 participants to collect data. To analyze the data, the researchers used the partial least squares (PLS) method. The study concluded that social influence, facilitating conditions, and personal innovation in information technology had a significant impact on physicians' behavioral intentions to adopt electronic health record systems, while in contrast, effort expectancy ($\beta = -0.02$, $p > 0.05$), performance expectancy ($\beta = 0.08$, $p > 0.05$), and resistance to change ($\beta = 0.03$, $p > 0.05$) had no effects on behavioral intention. The results indicated the need to develop a social strategy that encourages doctors to adopt electronic health records, in addition to focusing on technical competence and effective training.

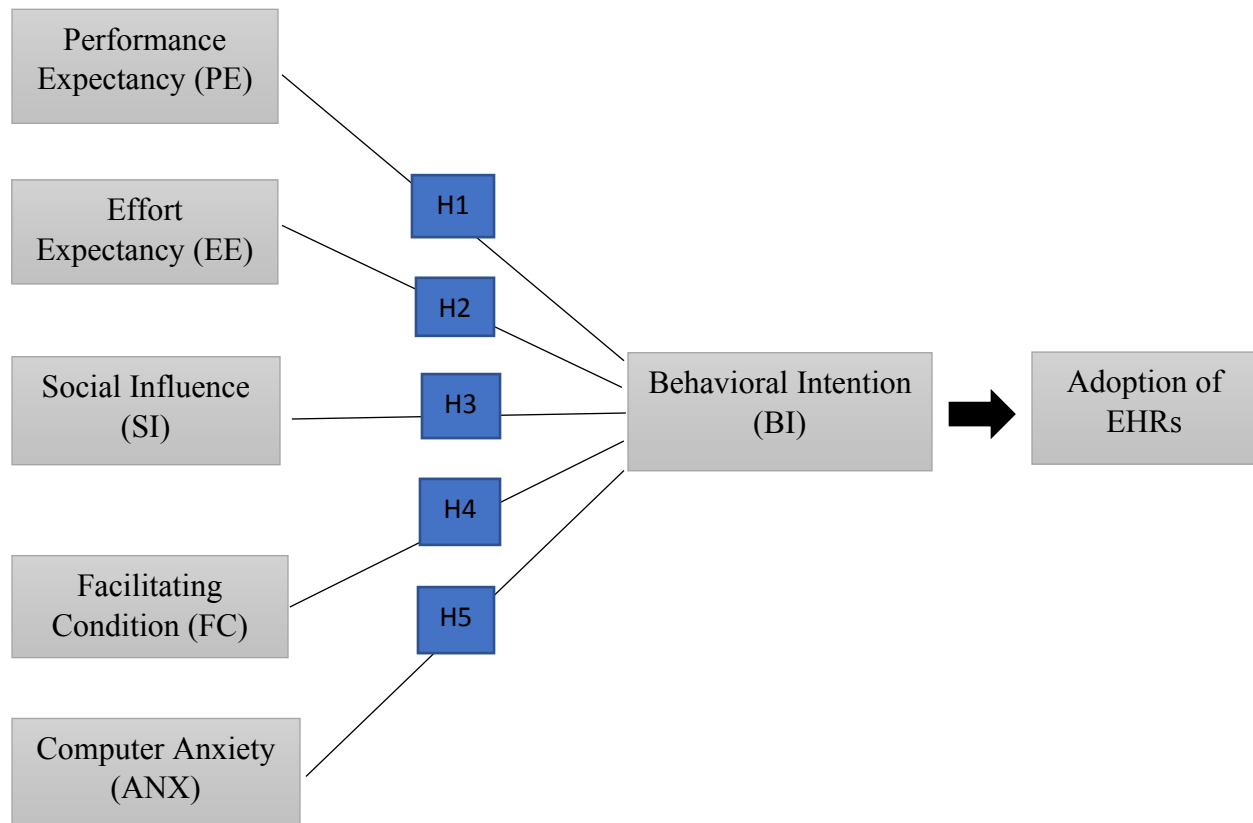
In general, these studies emphasize the importance of technology acceptance models, especially the Unified Theory of Acceptance and Use of Technology, in analyzing the interaction between variables and identifying the factors that most influence behavior toward technology acceptance. The standardized coefficients (beta values) extracted from these investigations highlight the diverse influences of variables such as performance expectancy, effort expectancy, and social influence on professionals' behavioral intentions. The intricate insights garnered from these findings serve as a robust foundation for researchers and practitioners alike. This has led to this theory being considered appropriate in studying the behavior of workers towards the use of electronic health records in Libyan health institutions and predicting the factors that affect this process.

Figure 6 displays the model that will be used to analyze the behavior of workers in the Libyan health sector in relation to the use of EHRs. This model was designed based on the

unified theory of acceptance and use of technology, with some modifications that serve the purposes of the research.

Figure 6

Research Model - Technology Acceptance Model



Derived from UTAUT (Venkatesh et al., 2003).

The relationship between the variables is estimated using relative weights that are statistically estimated by linear regression through an analysis program such as SPSS.

Behavioral Intention (BI) $\rightarrow$ Adoption and actual use of EHRs

$$BI = f(PE, EE, ANX, SI, FC)$$

$$BI = PE + EE + ANX + SI + FC + e$$

- Performance expectancy (PE) refers to the degree of belief that the individual using the EHR system will perform better. Per Asastani et al. (2018), “This variable is derived from the previous models, namely perceived usefulness.”
- Effort Expectancy (EE) refers to the ease of use of the technology (EHR) (Ayaz & Yanartas, 2020).
- Facilitating Conditions (FC) refers to the perceived extent to which the organizational and technical infrastructure required for the support of the technologies exists (Venkatesh et al., 2003).
- Social Influence is “The degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh et al., 2003, P.451)
- Behavioral Intention (BI) refers to the “... size of the strength of one's purpose to perform a behavior” (Asastani et al., 2018, p.323).
- Computer Anxiety (ANX) refers to the degree of “...an individual’s apprehension, or even fear, when she/he is faced with the possibility of using computers” (Venkatesh, 2000, p. 349).

By testing the following hypotheses (Venkatesh, 2008), this research seeks to learn the factors that affect workers' intentions to use electronic health records.

The hypotheses are:

H1: Performance Expectancy (PE) has a significant influence on Behavioral Intention.

H2: Effort Expectancy (EE) has a significant influence on Behavioral Intention.

H3: Social Influence (SI) has a significant influence on Behavioral Intention.

H4: Facilitating Condition (FC) has a significant influence on Behavioral Intention.

H5: Computer Anxiety (ANX) has a significant negative influence on Behavioral Intention.

After determining the main study variables, a structured questionnaire that includes all the target axes will be constructed and then distributed to the sample, and by analyzing these data using statistical methods and making sure the estimation of these variables is of a good quality, we can interpret the results and find the relationship between the variables.

Chapter Three: Methodology

3.1 Research Methodology:

The research is designed and classified based on the nature of the phenomenon under study, the research questions, and the objectives (Creswell, 2014). The researcher believes that a case study research strategy is particularly suitable for exploratory studies, which is what applies to this study and that using the mixed method is the appropriate technique to collect and analyze the research data. The following explanation justifies the researcher's choice.

In social sciences, "case study" refers to both a method of analysis and a particular research design for carrying out an empirical investigation (USC Libraries, 2020). Instead of referring to the case study as a design or technique, however, some scholars refer to it as a research strategy. According to the Justice Research and Statistics Association (2021),

Since any case study can involve a combination of methodologies, describing it as a strategy arguably better captures the full range of applications for which a case study can be used, as well as its unique value in relation to other approaches for answering research questions. (p. 1)

Saunders et al. (2009) found that explanatory case research is an inductive technique where evidence gathered from one or more case sites is systematically analyzed and synthesized to allow concepts and patterns to emerge for the purpose of constructing new theories or expanding existing ones. According to Bhattacharjee (2012), a case study is defined as “the method of intensively studying a phenomenon over time within its natural setting in one or a few sites” (p. 40). Meanwhile, Creswell (2014) explained that the strength of this research method lies in its ability to discover and explain a variety of overlapping social, cultural, and political factors which may not be known in advance that are potentially related to the phenomenon of interest.

Bhattacharjee also added that this method is well suited to the study of complex organizational processes involving multiple participants and the interaction of sequence of events, such as organizational changes and large-scale technology implementation projects. Furthermore, some literature has dealt with instances of studies that have examined the efficacy of the case study approach in the information system sector, such technology adoption and other areas where it has shown helpful (Bhattacharjee, 2012; Creswell, 2014; Saunders et al., 2009). As stated by Yin (1990), “In general, case studies are the preferred research strategy when ‘how’ or ‘why’ questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context” (p. 13).

Usually, case study research uses a variety of sources of proof, such as written records, firsthand observation, and methodical interviews. Its distinctive strength is in its capacity to cope with a broad diversity of data, and as a result, it is vividly descriptive and is based on extensive and varied sources of information (Yin, 1990, p. 20). In the context of a case study, information is investigated and mined to provide a more detailed analysis of the phenomenon under consideration (Algozinne & Hancock, 2006). Algozinne and Hancock (2006) also noted that the methods used in case study research for collecting and analyzing data could be based on quantitative, qualitative, or mixed-method survey models.

In natural sciences, quantitative research methods are often used, and are linked to objective data collecting, transparent procedures, and verifiable results (Daft, 1983). In other words, numerical data are the primary type of data gathered to research the phenomenon. According to Silverman (2015), a phenomenon is understood in quantitative research through numerical measurements and correlations between several variables in big data sets.

According to Feagin et al. (1991), most quantitative social science research methods are surveys, which are means of gathering data from a large number of individuals who reflect the population or a random sample of the population, revealing associations and causal effects among several factors (Hakim, 1987). In general, quantitative approaches are quite rigid, which has the advantage of allowing for meaningful comparisons of answers between participants and research sites (Natasha et al., 2005). Surveys, on the other hand, do not provide a comprehensive grasp of the context and history of a specific phenomenon. Galliers (1992) stated that another worry about employing surveys is that they may give little insight into the reasons or processes underlying the phenomenon under examination.

As a result, the use of surveys for this study is essential in order to reach a large number of persons to examine their behavior towards the usage of EHRs and comprehend the key variables affecting their decisions as to whether to embrace this technology. Moreover, additional information that supports the research is exclusively available through this method.

Conversely, qualitative research techniques are widely used in social sciences (Daft, 1983). Strauss and Corbin (1998) stated that “qualitative methods can be used to obtain the intricate details about phenomena such as feelings, thought processes, and emotions that are difficult to extract or learn about through more conventional research methods” (p. 11), and this type of study gives researchers the chance to examine written and verbal accounts of actual events in order to better understand them (Myers, 1997; Silverman, 2015). According to Myers (2013), people and their perceptions, understandings, and behaviors are the major sources of data in qualitative research when the researcher's goal is to comprehend the significance of a phenomenon in a social context.

Based on the above, it can be said that one benefit of qualitative case research is that it provides an in-depth insight into the topic being studied; however, the study sample size is typically rather small when personal interviews are used. While this gap can be overcome by using the quantitative method, in which the study population is relatively large, which enables conducting various studies on the relationship between variables, this method may lack the accuracy that characterizes the qualitative method. The advantages of the two methods may be acquired by using a mixed-method approach in the investigation. Regarding this approach, Guetterman et al (2015) stated, “Mixed methods research is the collection and analysis of both qualitative and quantitative data and its integration, drawing on the strengths of both approaches” (p. 554).

According to Creswell (2009), research is classified as quantitative, qualitative, or mixed based on the predominant nature used in the research. If most of the research is based on a quantitative approach, the research is referred to as quantitative. On the other hand, research is classified as qualitative if most of the research is based on the qualitative approach, whereas research is classified as mixed if the two methods are relied on approximately equally.

Mixed methods were used in this research; however, the research tends towards the qualitative approach, and therefore, according to Creswell's opinion, it is classified as qualitative. Thus, this research is considered to be a qualitative case study designed to explore the opportunities and challenges of EHR adoption in the Libyan health sector from real-life contexts at multiple sites (four hospitals in Tripoli city) using the mixed-method approach to collect and analyze data from questionnaires, interviews, documents, bulletins issued by the health sector, and administrative control reports on the sector's work.

3.2 Case Study Research Process

There are various characteristics or elements that may distinguish the case study method and are frequently included in this form of research. For example, Perry et al. (2005) established the following case study criteria:

- Research questions are set out at the beginning of the study.
- Data are collected in a planned and consistent manner.
- Inferences are made from the data to answer the research questions.
- A phenomenon was explored, and an explanation, description, and causal analysis produced.
- Threats to validity are addressed in a systematic way.

Based on the comparison suggested by Wohlin et al. (2000) and Kitchenham et al. (2002), the procedure is almost the same for every sort of empirical investigation. However, because case study methodology is a flexible design technique, there are different iterations of the processes involved (Andersson & Runeson 2007). According to Runeson and Höst (2009) and Davies (2011), several essential steps need to be followed while conducting a case study:

Step 1: Establish a broad case to investigate.

Step 2: Establish the research question(s).

Step 3: Select the precise case(s) to study.

Step 4: Determine the data-gathering and analysis techniques.

Step 5: Prepare for the data collection by determining the appropriate processes and protocols.

Step 6: Data collection and analysis.

Step 7: Reporting

Some studies add two more steps to the process of building theories from case study research, such as that by Eisenhardt (1989), which added hypothesis formation and enfolding literature steps.

3.3 Data Collection

Given the design of the study and the scope of its subjects, a variety of sources was a requirement for getting trustworthy data that could be evaluated, as well as for dependable and thorough conclusions. According to Tashakkori and Teddlie (2003), triangulation is a technique that involves a combination of data collection to get good results, as the validity of the study can be demonstrated if the topics incorporate several data sources or viewpoints from various individuals. According to Creswell (2009; 2013; 2014), the evidence from the various sources can be used to build a justification for the themes, allowing for the triangulation of many data points.

The current study used a mix of methods that would complement each other with the aim of achieving the best results possible. The logic behind the triangulation strategy is that by using many data-gathering methods, the researcher can get the best of each while overcoming their individual shortcomings. Denzin (1978) indicated that the weaknesses of one data collection method were typically the strengths of another, and triangulation can therefore help increase the likelihood that a study's findings and interpretations will be considered credible (Lincoln & Guba, 1985).

Thus, multiple data collection methods were employed in this study, namely interviews, questionnaires, and documents. Given that the key objective of this study was to explore the opportunities and challenges of adopting electronic health records in Libyan health institutions,

the data were collected using multiple sources of evidence based on the study protocol. Thus, the sources of data included were not just limited to interviews, questionnaires, and documents.

3.3.1 Semi-structured Interviews

In the semi-structured interviews used for this study, open-ended questions were utilized to give participants the chance to elaborate on personal experiences while providing pertinent information that could support prevailing notions in the literature (Yin, 2003). DeSilets (2007) mentioned that individuals frequently feel more at ease speaking with someone directly than replying to printed forms, and interviews also allow for the collection of unscripted, in-depth information, the examination and clarification of responses, exploration of sentiments related to the subject, and the discovery of problems that the researcher may not have been aware of (DeSilets, 2007). Riege (2003) hypothesized that the order in which interview questions are asked might reveal interview bias, and therefore, to obtain the largest amount of information, the nature of the questions was open and subject to branching based on the job of the person responding.

The fact that the findings of interviews are not always representative of the wider community from whom participants are recruited, and should not be taken as such, is one of the method's drawbacks, in addition to the usual small numbers of participants. The primary characteristic of the method is that it is exploratory, with the goal of illuminating reasons and specific ideas (Edmunds, 2000). Time restrictions for interview subjects and interviewers are another problem, and the absence of uniformity implied by interviews might occasionally raise questions about accuracy and biases. On the other hand, they offer a wealth of content.

Interviews were conducted with four seasoned employees from various disciplines at each institution, and each interview included several open-ended questions that served the

purposes of the research (see Appendix P). The duration of each interview ranged from 30 to 40 minutes. All interviews were conducted within the targeted institutions, following a pre-prepared protocol that included all ethical and administrative arrangements (see Appendix M and N).

The interviews were performed with the primary goal of understanding some of the challenges hindering the implementation of EHRs in Libyan health facilities. Factors that required in-depth understanding and could only be accessed by using these tools included things like perspectives and perceptions about technology acceptance factors, available administrative and technological capabilities, concerns that may arise from the use of these records in Libyan health institutions, the extent to which the benefits of their use are realized, and other topics. Interviews also provided an excellent opportunity for the researcher to investigate these institutions, get the facts from knowledgeable sources, and take notes on the subject.

3.3.2 Questionnaire

The second major instrument for data collection was a structured questionnaire comprising a pre-formulated set of written statements based on the unified theory of acceptance and use of technology (UTAUT) from Venkatesh et al. (2003). The questionnaire was necessary for the study for a number of reasons, the most important of which being that the information required about the study population's behavioral intentions regarding the use of electronic health records could only be obtained through this tool. In addition, compared to the use of interviews, questionnaires can reach a larger number of respondents at once, are less expensive, take less time, and do not require as many specialized skills (Amin, 2005; Mugenda, 2008; Mugenda & Mugenda, 2003). The questionnaire was created using many guidelines, publications, and existing surveys from the literature (Ackerman et al., 1999; Holden & Karsh, 2010; Jensen et al., 2005; Venkatesh et al., 2003).

The questionnaire was prepared to study the attitudes of health sector workers regarding the use of electronic health records. Most questions were answered using a 5-point Likert scale (strongly agree to strongly disagree), with other questions being straightforward and direct (Yes/No answers) with space for any recommendations or comments. The questionnaire targeted doctors, nurses, administrators, and health technicians (Appendix K) and consisted of the following parts. The first section of the questionnaire comprised demographic questions to offer an overview of the sample's characteristics. Based on the assumptions of the Unified Technology Acceptance Theory, the second portion of the questionnaire focused on numerous axes that allowed the analysis of behavioral intentions towards the use of electronic health records and the factors that influence them, while the third section investigated additional aspects such as computer self-efficacy, willingness to learn, and so on.

3.3.3 Documentation

Documentation was used in this study as a secondary source of information to help identify the issues that Libyan health institutions face in carrying out their duties, and to investigate the potential challenges in using information technology in the health sector, particularly electronic health records, as well as the potential benefits of doing so.

Documented data are very useful for qualitative case studies, since they may place an inquiry in a particular context and give specifics about the issue being researched (Merriam, 1988). Merriam (1988) characterized documents as a ready-made source of data that is immediately available to the investigator, and according to Bowen (2009), document analysis has advantages for qualitative research because it is a productive approach that relies on data selection rather than data gathering, which saves on time and cost. Public documents like newspapers, meeting minutes, and official reports, as well as private documents like letters, e-

mails, and personal diaries and articles, can all be useful types of documents (Creswell, 2014). Another factor that makes document analysis useful is accessibility, as documents may be obtained in many different formats and are typically free and simple to access. Also, papers may be read again without the researcher's actions affecting them, since they are stable and "non-reactive" (Bowen, 2009, p. 31).

Several different kinds of documents were used to support this study, including reports from the Administrative Control Authority evaluating the health sector for different years, reports issued by the Central Bank of Libya for different years, health-related articles that were found on the websites of the Libyan Ministry of Health and other countries, as well as the Libyan Health Law (106) and the Communications Law of 2022 (see Appendix T: List of Documents).

3.4 Research Rationale

Given that the main purpose of this study is to explore the opportunities and challenges of adopting electronic health records in Libyan health institutions, and thus gather knowledge that helps build a strategy for adopting such records, a mixed-method case study research approach was used. This is because according to Creswell (2018), this approach is appropriate for examining an issue within a context about which little is known, which in this case is the implementation of EHRs in the Libyan health sector. Because EHRs have yet to be adopted in the Libyan health sector and have had only limited usage in the region, there are gaps in the literature that can only be filled through such research.

A good research design follows a logical progression from the gathering and analysis of empirical data to the findings in order to address the original research questions. According to Yin (2009), to address "what," "why," and "how" research issues, an exploratory qualitative study is typically employed in empirical research (pp. 24-26).

The research was designed to answer the following questions:

- How do EHRs improve the quality of healthcare services in Libya?
- What are the challenges to the adoption of EHRs in Libya?
- What strategies are available to leverage the adoption of EHRs in Libya?

To answer these queries, the research was performed with the following approach.

The first part of the study was a literature review of the extent to which electronic health applications, particularly electronic health records, are used in Libya and other North African countries, as well as the plans that these countries have used. This is in order to discover the most important obstacles faced by these countries in particular, and some countries in the region in general, to develop a framework for the success of implementing EHRs in Libya, including the strategy that must be followed.

The second part of the research focused on studying the Libyan health sector and highlighting the problems it faces, as well as how the opportunities brought by electronic health records will help to re-engineer this sector and improve the quality of health services.

Meanwhile, the third part of the research dealt with the study of the obstacles facing the adoption of electronic health records in the Libyan health sector, and whether they are technological, institutional, cultural, etc. Four health institutions were studied and utilizing qualitative and quantitative data collection and analysis methods, the unified theory of acceptance and use of technology was employed to study the attitudes and behaviors of workers towards the use of these records and the reasons behind them.

Finally, the results and recommendations that were reached were compiled in the form of a clear framework that could form the nucleus of a general strategy for the implementation of electronic health records in the Libyan health sector.

3.5 Role of the Researcher

In a qualitative case study, the researcher is involved in every aspect of the research process, from gaining access to research sites and managing ethical issues to coordinating data-gathering and analysis (Merriam, 1988). Another important part of this role is ensuring that ethical principles are followed and that approvals are obtained, as appropriate, to carry out the research. In this study, official letters were sent to hospitals seeking permission to conduct the research. The correspondence included copies of the interview questions, the survey tool, the ethical clearance form from the University of Ottawa, and a detailed protocol outlining the research methods. Particular attention was paid to the protection of participants' rights and confidentiality, an aspect that was much appreciated by hospital administrators and helped to facilitate the quick approval process. Creswell and Poth (2017) argue that following ethical principles and providing clear specifications of research purposes are important in gaining trust and confidence among participants.

Additionally, it is important to consider the background of the researcher, since this will determine the direction of the study and impact its interpretations, and acknowledgment of personal biases, values, and experiences can enhance the transparency and validity of the research effort itself (Creswell, 2009; Yin, 2014). The researcher in this case was born, raised, and educated in Libya. His academic path started with obtaining a bachelor's degree in economics and then pursuing opportunities at the Central Bank of Libya and the Libyan Food and Drug Control Center; later, he became a university professor after obtaining his master's degree. In the current case, the fact of being an indigenous person from Libya with extensive experience in high-ranking administrative and academic positions contributed to the researcher gaining deeper knowledge regarding various challenges and opportunities facing the health sector in that country. Such inside status permitted easy navigation of both the cultural and institutional contexts, a fact corroborated by Rubin and Rubin (2012) when they point out the importance of being contextually aware when performing qualitative research.

The researcher's approach to data collection involved systematic planning and intensive engagement. Over 12 weeks, data collection was conducted in four hospitals, with three weeks allocated

to each hospital. During this period, the researcher was actively present, distributing questionnaires, answering inquiries, and following up with participants. According to Bryman (2016), close engagement during data collection builds rapport with participants and enhances the quality and reliability of the data. Interviews were carried out systematically following a comprehensive protocol. Invitation letters, including information on the gravity of the research and the value of the participants' contribution to helping the study, were first sent out. This approach, as described by Maxwell (2013), is important in increasing participation and ensuring quality qualitative data.

Furthermore, the researcher used a mixed-methods approach which included both quantitative and qualitative data, and triangulation, including the synthesis of different data sources and methodologies, was applied to increase the validity and credibility of the research findings (Denzin, 2012). Qualitative analysis helped in understanding important patterns and results drawn from the quantitative data, thus informing a more complex understanding of the experiences and attitudes of the participants. For example, the qualitative analysis revealed some core elements of anxiety and effort expectancy that helped frame the quantitative survey results. This is in line with the approach by Flick (2018), who states that qualitative inquiry can deepen insights obtained using quantitative methods.

Despite efforts to minimize bias, however, it is acknowledged that the researcher's dual status as an insider (being a native of Libya) and an outsider (being a doctoral candidate studying overseas) might bring along some potential biases. Being cognizant of these considerations, the researcher reflected critically on how such personal experiences and perspectives could shape the data interpretation. Following the recommendations of Creswell and Plano Clark (2018), being transparent throughout this process helped to enhance the reliability and validity of the study. Through effective planning, active engagement, and adherence to ethical standards, the researcher was able to collect a significant amount of data and achieve high levels of participation. This therefore helped in drawing a proper understanding of the challenges and opportunities involved in adopting e-health in Libya.

3.6 Site Selection

As noted, this research was conducted in Libya, in the city of Tripoli, for several reasons, including the fact that it is the capital and the largest city in the country in terms of population. As mentioned earlier, according to the World Bank's predictions for 2020, the population of Libya is around 6.9 million people, while the population of the city of Tripoli constitutes 19% of the population, or about 1.3 million people. In view of the conditions that Libya is going through since the 2011 revolution and the states of instability that the country witnesses from time to time, the city of Tripoli is considered relatively safe compared to other regions, especially in recent years after the ceasefire agreement of October 2020 (WHO, 2021). This enabled the researcher to move freely and safely between hospitals and some related institutions to collect research data.

To conduct the research and collect information, four different public hospitals with different capacities and specializations were selected, which were: Tripoli Medical Center (the educational hospital), Tripoli Central Hospital, National Heart Center (Tajoura), and Khadra Hospital.

- Tripoli Medical Center is an educational facility and one of the largest hospitals in Libya. It provides medical services in various specialties and has 1,438 beds.
- Tripoli Central Hospital has 925 beds and is one of the oldest hospitals in Libya.
- Khadra Hospital contains 600 beds and has experience using information technology.
- The National Heart Center (Tajoura), which has 282 beds, is primarily a hospital for heart diseases, in addition to some other specialties (data are from the statistical report of the Libyan Health Ministry for 2019).

3.7 Population and Sampling Design

To collect the primary data, the research relied on interviews and a questionnaire, and used the purposive sampling method in selecting the research sample. Purposive sampling, as described by Curtis et al. (2000), Emmel (2014), and Guetterman (2015), is the process of selecting the components or units that are most representative of the population under study or that will be most useful for the research. According to Merriam and Tisdell (2015), purposive sampling may be the best method of selection when conducting qualitative interviews, while Creswell (2013) noted that this technique generates information from the target population that is helpful in understanding the study topic. Also, purposive sampling is a method for locating and choosing cases with plenty of information and helps to conserve effort, time, and costs (Patton, 2002). More precisely, sampling in qualitative research offers novel theoretical ideas, divulges distinctive characteristics of individuals or social contexts, and deepens comprehension of complicated situations, events, or relationships (Neuman, 2011a).

However, according to Runeson and Höst (2009), in case studies, statistical generalization is not possible since the case is not a ‘sampling unit’ and the number of respondents would most likely not be enough to represent any larger population. Still, while analytical generalization might lead to a working hypothesis that can be further examined, it also illuminates theoretical notions or principles (Yin, 2014). As mentioned earlier, multiple methods of data collection (data triangulation) were relied upon for this study. Besides the interviews, a questionnaire was also used to collect research data, which allowed for a larger number of participants and to take advantage of the complementary advantages of the data triangulation method, since as noted previously, the weaknesses of one method of data collection are the strengths of another (Denzin, 1978).

In this regard, Hair et al. (2006) referred to "indicative controls" for generalizability based on the size of a sample, as they noted that for most scientific research, the sample size generally ranges between 30 and 500, and that in order to divide samples into sub-samples, such as in case studies, it is necessary that the sample size be at least 30 for each category for the study to acquire the threshold for generalization. In multivariate research, the sample size must be ten times greater than the number of variables in the study in order to give good statistical results and thus acquire generalizability (Hair et al., 2006), and so because in the current study, the number of variables was six, the minimum number of sub-samples should not be less than 60.

With regard to the interviews, four participants from each hospital were identified, provided that they meet the criteria that were previously determined, such as being currently employed at the hospital, having at least eight years of experience, etc. (see Appendix M). As for the questionnaire, 40 participants, each currently working in one of the targeted specialties, were selected from each hospital. Thus, the target number was 16 volunteers for the personal interviews and 160 participants for the questionnaire.

3.8 Data Collection Process and Ethical Considerations

As mentioned above, the study relied on a mixed-method approach for collecting data that included both qualitative and quantitative methods, which involved interviews and questionnaires respectively. To collect the data, necessary approvals were first obtained, including ethical approval from the University of Ottawa and permission from the targeted hospitals to conduct the research (see Appendices G and H). Following approval from the targeted hospitals, a preliminary, experimental form of the questionnaire was distributed to 32 participants. Then, it was collected, analyzed, and a minor modification made to it, as clarified in

the section on validation, and thus the questionnaire was ready for distribution to the study sample.

Beginning with the interviews, the persons involved were identified, and the researcher expected them to have valuable information that would help to answer the research questions. The participants also met the predetermined criteria, such as years of experience and job title, with the snowball technique being followed to reach some participants.

Since all the interviews were conducted face-to-face, a pre-planned protocol was followed to organize this process, starting with inviting each participant through an official letter containing an overview of the research and its purpose. Upon approval, the participants were asked to sign the consent form, with audio recording being optional, in addition to reminding each participant that they could withdraw from the interview process at any time. Furthermore, to minimize risk, the form includes contact information for the researcher and supervisor, as well as contact information for the University of Ottawa Research Ethics Protocol Officer if a participant feels the need to inquire about any ethical concerns (see Appendices A, C, D, E).

Sixteen interviews were conducted, with four at each hospital, and the time span for each interview ranged from 30 to 40 minutes. All interviews took place during official working hours and within the relevant medical facilities, following the protocol, except in one case where the interview took place after official working hours due to the nature of the participant's work and their obligations.

The interviews were conducted with the target segments that served the research purposes from different specializations, namely doctors, administrative officials, nurses, and information technology specialists. At the end of each interview, the text was reviewed with the participant to verify the information that had been written down by the researcher and to add any other

observations or comments. These interviews were an important source of information that could not be obtained by any other means.

After arriving at the final form of the questionnaire and obtaining good results from the pilot study, it was considered valid for use as a good tool for data collection, and following protocol, the researcher proceeded to distribute it to the sample within the targeted hospitals, which involved 40 participants from each (see Appendix G).

Each questionnaire was accompanied by an explanation of the concept and goal of the research, and it further stated that completing the form constituted an implicit agreement to participate and that the questionnaire would contain no personal identifiers. Therefore, participation was risk-free and entirely voluntary.

The researcher allocated about three weeks for each hospital, where the questionnaires were distributed in the various departments that had been previously identified as being expected to serve the purposes of the research. Before the end of each shift, the forms were collected and any inquiries from the participants were answered. Also, during that time, interviews were also being conducted or coordinated.

Following the completion of the allotted three-month data collection period, all 16 planned interviews were complete, and 143 out of 160 questionnaires had been collected.

3.9 Interview Data Analysis Process

For this study, a qualitative approach using codes and appropriate coding techniques was chosen for the thematic analysis. Thematic analysis is one of the most frequently applied methods for examining qualitative interviews, and involves searching for, examining, and reporting common patterns, called themes, within a dataset (Brown & Clark, 2006). In the realm of qualitative research, this type of analysis can be defined as the systematic process of

examining, classifying, tabulating, testing, and recombining evidence with a view to deriving conclusions based on empirical evidence (Yin, 2009). This methodology was chosen primarily because it is a very systematic and objective approach that is likely to enable insightful analysis regarding specific research enquiries.

For thematic analysis of the data from the interviews, a detailed and rigorous process had to be followed in order to distill and interpret such rich information. This involved the word-by-word transcription of each interview, and as part of the process, this step allowed for thorough familiarization with the content, which aligns with the approach advocated by Braun and Clarke (2006) for the immersion stage of becoming familiar with data. The next stage was the initial coding, during which 87 different concepts were identified through careful reading and re-reading of the transcripts. Identification of the concepts was done through the segmentation of text into meaningful units, and then giving labels to those units in the form of codes that reflect the key ideas therein. Braun and Clarke (2019) underscored the importance of this coding in capturing the essence of data and laying the ground for developing themes. After the coding, themes were identified and the data organized accordingly, so that the many initial codes were aggregated into fifteen different themes representative of broader patterns and ideas that had emerged across the interviews. These topics were further refined into three subthemes and classified into three basic categories. Guest et al. (2012) supported the development of themes and their eventual refinement, stating that grouping codes into coherent themes leads to meaningful insights.

According to Charmaz and Belgrave (2012), analytical memoranda allow researchers to go through the data, create categories, find gaps in interviews, and define intervening factors. In this study, analytical memoranda were used to think through relationships and inconsistencies in the

data in order to look for recurrent or conflicting themes within the categories, but they were maintained separately from the data during the coding processes. In the present study, thematic analysis was conducted manually, with no aid from software tools. This is in line with the discussion by Joffe and Yardley (2004) regarding the practicalities of content and thematic analysis, in which the authors described a detailed, iterative process for examining data. Each theme and sub-theme were carefully checked again for proper representation of the data. This iterative process refines themes and checks their relevance, as recommended by Nowell et al. (2017). It is worth noting that through the iterative analysis process, no new themes, subthemes, or important insights emerged after approximately the fourteenth interview, which is the saturation point.

Then, a final report with the themes and categories duly organized was prepared which gave a detailed account of the findings, wherein each of the identified themes was supported with illustrative quotes and examples from the interviewees. The report synthesized data into a coherent narrative, highlighting key insights and implications derived from the analysis. This approach ensured that the interview data were thoroughly examined and that all the findings were presented in a very organized and structured way, taking into account the principles put forward by Braun and Clarke (2006) and other key researchers.

3.10 Trustworthiness

To ensure that results are useful and meaningful, qualitative data must be gathered and its themes evaluated in a thorough and methodical manner. This is critical for ensuring the credibility and dependability of the study results (Runeson & Höst, 2009). According to Patton (2002), “assessing credibility in qualitative research is different from the process used in quantitative research, in that credibility in quantitative studies is based on tools, but in qualitative

studies, the researcher is the instrument" (p.14). Credibility conveys to others that they can trust a study as a source of information; in other words, it represents the extent to which the information or findings obtained by the study are considered true. According to Rubin and Rubin (2012), "credibility comes not only from who you interview and how effectively you check what they say; it also comes from telling readers how well you conducted the study" (p.67), and as a result, attention is paid to factors that increase the study's credibility.

Due to the nature of the research and its use of the mixed-method approach in collecting and analyzing data, the reliability of the results was tested according to the two methods, as follows. To begin, the data sources were triangulated, which refers to the use of different methods or data sources to gain a comprehensive understanding of a phenomenon (Patton, 1999). This technique was used because the study relied on a variety of sources for the research data (literature review, conducting semi-structured interviews, researcher's observations, and a questionnaire).

The data collection tool (questionnaire) was chosen and built based on previous studies with similar purposes, with some modifications being made to suit the context of the current research.

The questionnaire and interview scripts were subjected to scrutiny by the supervision committee in order to test for biases and to ensure the accuracy of their phrasing for measuring the intended constructs. This evaluation encompassed an assessment of the clarity of formulation, alignment with the specified axes, and adequacy in covering the study's primary variables, alongside the necessary personal and functional characteristics of the respondents. The committee meticulously examined all content, offering valuable insights and proposing

amendments, which were instrumental in refining the questionnaire and interview scripts, ultimately leading to their scientific validation.

Given that data will be collected from various Libyan health institutions, with Arabic as the official language, the researcher undertook the translation of questionnaire questions, interviews, and associated documents into Arabic. These translated materials were then submitted to a language translation expert who provided valuable observations and made necessary modifications. Subsequently, the documents were shared with six doctoral candidates based in Canada, all of whom were native Arabic speakers. The researcher sought their responses to the questions, seeking insights on language clarity, comprehensibility, and overall coherence.

In addition to this feedback loop, interviews, each lasting between 30 and 40 minutes, were conducted with four volunteers. The volunteers primarily provided feedback on language clarity, suggesting substitutions for specific terms while noting that the core content remained largely unchanged. Consequently, following the adjustments, the final version of the interview form was established, and the questionnaire was prepared for distribution in the pilot study.

Due to the specificity of the quantitative data collection tool (questionnaire), a pilot study was conducted that included 32 participants and which was assessed and validated for data collection (details are shown in the next step). It was then given to the actual study sample.

During the data collection process, notes were also taken by the researcher. All 16 interviews were conducted in Arabic, and all interviews were one-on-one. At the end of each interview, the text was reviewed with the participant to check for any misinterpretations or incorrect perceptions of their ideas and points of view, and additional notes were added if necessary. The utmost was always done to ensure that the data were handled and dealt with responsibly.

3.11 Pilot Study: Reliability and validity of the questionnaire.

To assess the statistically reliability and validity of the questionnaire, a pilot study was conducted that included a sample of 32 volunteers, and the data were analyzed using the Statistical Package for the Social Sciences (SPSS).

3.11.1 Reliability

Reliability refers to the degree to which a measurement consistently produces stable results for a given phenomenon (Carmines & Zeller, 1979). The Cronbach's alpha coefficient is a widely used internal consistency measure and is particularly suitable for assessing reliability when employing Likert scales (Robinson, 2009; Whitley, 2002). Although there are no strict rules for internal consistency, most studies agree that the Cronbach's alpha coefficient should not be less than 0.7 (Robinson, 2009; Whitley, 2002), and in experimental studies, this coefficient is considered acceptable if its value is equal to or greater than 0.60 (Straub et al., 2004). Typically, items or questions not meeting the required reliability threshold are either eliminated or the researcher makes adjustments to enhance reliability, depending on the items' or questions' significance. The findings from the pilot study, as shown in Table 2, revealed that the Cronbach's alpha value for all axes exceeded the acceptable level of 0.7, indicating a strong internal consistency. Also, composite reliability (CR) values for constructs were all above the 0.7 threshold, confirming the reliability of the questionnaire as a measurement tool (Hair et al., 2010).

3.11.2 Validity:

As defined by Henrysson (1963), content validity "refers to the extent to which the items in a questionnaire are representative of the entire theoretical construct the questionnaire is designed to assess" (p.211). A lack of construct validity may negatively affect the reliability of a

study's results and hinder the interpretation of relationships between the study's variables. Hair et al. (2014) posited that a construct is valid if the result for an Average Variance Extracted (AVE) is > 0.5 and the minimum value of the loading factor is > 0.5 , or ideally > 0.7 . The AVE for each variable in Table 2 has a value of > 0.5 , indicating that the latent constructs showed convergent validity. In other words, each of the variables can explain more than 50% of the variance in the indicators (Ghozali & Latan, 2015). For each construct, the loading value has a value greater than 0.7.

Table 2

Pilot study results: Results of convergent validity indices

Variable / Dimension	Statement	Factor Loading	Cronbach's α	(AVE)	CR
Effort Expectancy	EE1	.74	.79	.620	.79
	EE2	.77			
	EE3	.82			
	EE4	.85			
Performance Expectancy	EP1	.83	.88	.654	.84
	EP2	.89			
	EP3	.80			
	EP4	.79			
	EP5	.84			
	EP6	.77			
	EP7	.85			
Facilitating Condition	FC1	.70	.89	.53	.81
	FC2	.76			
	FC3	.73			
Social Influence	SI1	.72	.76	.58	.72
	SI2	.81			
	SI3	.74			
Anxiety	ANX1	.79	.72	.61	.69
	ANX2	.81			
	ANX3	.76			
	ANX4	.73			
	ANX5	.80			
Behavioral Intention	BI1	.79	.84	.68	.82
	BI2	.83			

	BI3	.88			
	BI4	.86			
	BI5	.79			
	BI6	.80			

A correlation matrix was also used to assess the relationships between variables. Pallant (2001) claims that the relationship between variables is weak if the correlation coefficient value is 10-29, moderate if it is 30-49, and strong if it is from 50 to 100. Table 3 shows the values of the correlation coefficients between the main constructs of the questionnaire, which indicate the presence of a good correlation, with values ranging between medium and high at the statistically significant 0.05 level, thus providing evidence of the relationships between the constructs, as expected based on the basic theory.

Table 3

Inter-construct correlation matrix

Factors	EE	PE	FC	SI	AN	BI
EE	1					
PE	0.533**	1				
FC	0.499**	0.384**	1			
SI	0.440**	0.311**	0.406**	1		
AN	0.364**	0.453**	0.345**	0.450**	1	
BI	0.697**	0.520**	0.369**	0.390**	-0.411**	1

Factors: PE: Performance Expectancy; EE: Effort Expectancy; FC: Facilitating Condition; SI: Social Influence; AN: Anxiety; BI: Behavioral Intention.

** Correlation is significant at the 0.05 level (2-tailed).

This summary indicates that the questionnaire used in the pilot study demonstrates good reliability and validity. The reliability of the questionnaire was confirmed through the Cronbach's alpha values, which exceeded the recommended threshold of 0.7, indicating good internal consistency among the items. The validity was assessed through convergent validity tests, including factor loadings, average variance extracted (AVE), and composite reliability (CR), all of which supported the validity of the questionnaire constructs. Additionally, the significant

correlations between the main constructs provide further evidence for the questionnaire's validity. Overall, the statistical analyses confirm the questionnaire's ability to measure the key theoretical constructs reliably and validly.

3.12 Sample Composition and Distribution:

3.12.1 Sample Composition

Table 4 outlines the distribution of the sample across four public hospitals in Tripoli. Each hospital was selected deliberately to represent different facets of the health sector, including educational, central, cardiac, and general healthcare facilities. The target sample for each hospital was determined based on logistical considerations and the need for a balanced representation of different healthcare settings.

Table 4

Sample distribution:

Hospital	Target sample	Sample achieved
Tripoli Medical Center (The educational hospital)	40	38
Tripoli Central Hospital	40	36
National Heart Center (Tajoura)	40	34
Khadra Hospital	40	35
Total	160	143

3.12.2 Response Rate

Of the 160 questionnaires distributed, 143 were returned, for an overall response rate of 89.4%. Seven incomplete questionnaires were then excluded, leaving 136 questionnaires for rigorous analysis, representing 85% of the initially distributed surveys. This response rate is considered acceptable in research methodology (Dillman et al., 2009), adding credibility to the findings and ensuring the reliability of the obtained data. As previously mentioned, the target sample was obtained for the interviews, which involved conducting four interviews in each hospital. Chapter Five will review the results of the questionnaire analysis and interviews.

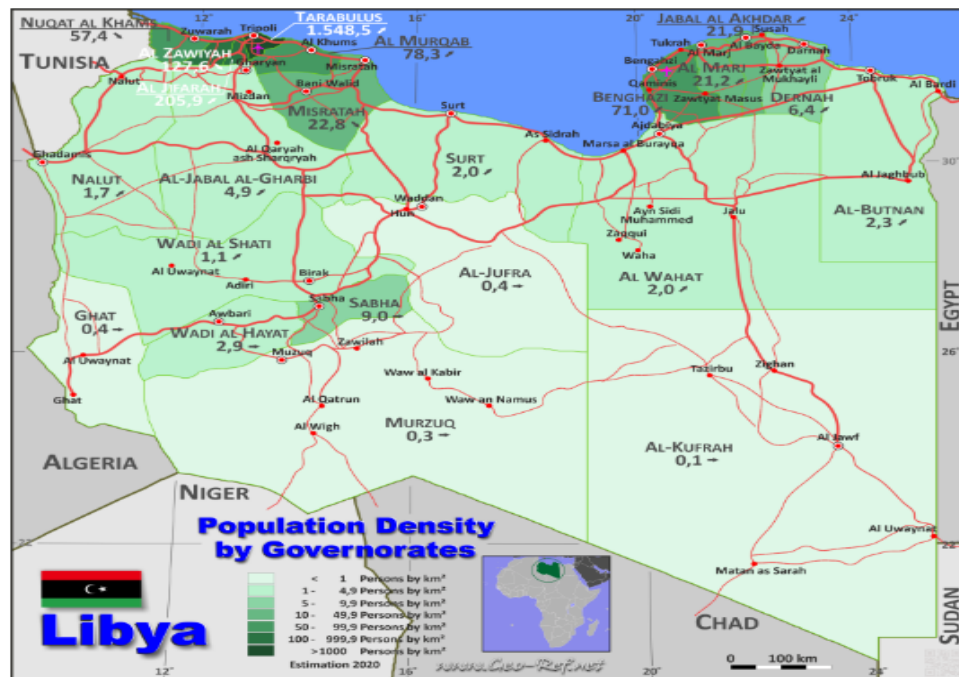
Chapter 4: Research Context

4.1 Libya: Geography and Social Demography

Libya, located in North Africa on the coast of the Mediterranean Sea, covers an area of 1,665,000 km², and has a national coast extending about 1,900 km. The country shares its borders with six others: Egypt, Sudan, Chad, Niger, Algeria, and Tunisia. Also, according to the Libyan Bureau of Statistics and Census (2017), as of 2006, the population of Libya was approximately 6.88 million people, with a growth rate of 1.5%, and the percentages of males and females being 50.7% and 49.3% respectively. That statistical report also indicated that nearly a third of the population was under 14 years old, with 67.5% being between 15 and 64 years old, and with the age group 65 years and over making up 4.5% of the total population.

Figure 7

Map of Libya showing location, population density, and borders



Source: GEO-Ref.net (2022)

The overall population density is about four people per square kilometer, with 85% of the population being concentrated in the areas of the northern coast, which represents 10% of the total area, while southern Libya, which is predominantly desert in nature, is home to only a small percentage of the population (Worldometers, 2023). The largest Libyan region in terms of population is the capital, Tripoli, followed by Benghazi, Misurata, Al-Jaffara, and Al-Marqab, respectively (Bureau of Statistics and Census-Libya (BSCL), 2020).

4.2 Health Care System

According to the World Health Organization (WHO) (2000), health systems are defined as “comprising all the organizations, institutions, and resources that are devoted to producing health actions” (p. 5). As asserted by the WHO (2000), a health system includes all the activities whose primary purpose is to promote, restore, or maintain health. Within a health system, there are various levels or domains of health care practices (Todd & Scarborough, 2023). They are described as having a pyramidal structure, with three or more levels of health care indicating increasing degrees of expertise and technical complexity. The majority of patients are seen at the first level of primary care, which is typically their first point of contact with the healthcare system, with decreasing numbers seen as they are filtered out of this first level and into higher levels of specialized care at secondary, tertiary, or higher levels according to the particular health system (Todd & Scarborough, 2023).

The WHO (2007) provides a framework consisting of six dimensions that constitute the general basic building blocks of a health system:

- A sustainable financing mechanism that prevents people from becoming impoverished as a result of healthcare costs
- A sufficient health workforce with the necessary skills and motivation

- A reliable health information system for policy and programmatic decision-making
- Well-maintained facilities with adequate medicines and appropriate technologies
- Robust mechanisms to deliver quality health services
- Robust stewardship to lead and steer the health system

On this basis, health systems can be evaluated. If they have these components, they will presumably be able to provide high-quality health services.

4.3 Libyan Health Care System

Health represents a fundamental axis of human development, and so the health sector is considered one of the most important sectors affecting human life and existence, as it is an essential sector for enabling citizens to enjoy socially and economically fruitful lives (Madyuni, 2018). Improving precarious health conditions and providing the highest possible quality of health care to the population represents one of the basic priorities of society.

Libya's health-care system has come a long way since 1951, when it began with meagre resources: 14 hospitals (1,600 beds) and a modest number of primary health centers (WHO et al., 2017). Since the beginning of the 1970s, development plans have paid great attention to various economic sectors, whether for production or service, but especially the health sector. To ensure that all citizens had access to health care, health facilities at various levels and with different specializations were built, comprising a massive infrastructure project that included hospitals, primary and secondary health care facilities, analysis laboratories, pharmacies, and so on, covering various Libyan villages and towns (Al-Kafri, 2022). According to the Libyan Public Health Law No. 106 of 1973, "health is a legitimate right for all people and is guaranteed by the state" (Article 1, p. 190). Under this law, health plans are designed and carried out to provide free health care to all inhabitants. Law 106 (Articles 2 and 3) also stipulates that the Ministry of

Health is responsible for organizing and supervising the public and private health sectors, including curative medicine, therapeutic pharmaceutical institutions and facilities, and drug handling and allied professions, as well as the development, monitoring, and supervision of health and medical services.

4.3.1 Libyan Ministry of Health

The Ministry of Health operates through an administrative and technical staff system and has a central organizational structure that includes central offices, departments, and institutions, as shown in Table 5. On the top of the pyramid of authority is the minister, who in turn leads the ministry, which directly manages 10 central institutions (see Appendix Q). Then comes the Undersecretary, who acts as the head of the ministry's office and administers the directorates and offices, each of which has specific competencies for managing the country's health system (WHO et al., 2017).

Table 5

Central offices, departments, and institutions of Ministry of Health

Offices	Directorates	Central institutions
- Minister's office - International cooperation - Internal auditing - Out-of-country treatment affairs - Legal affairs	- Primary health care - Private health sector - Hospital affairs - District health services - Human resources - Health construction project - Administrative affairs & services - Nursing - Health planning - Labs & blood banks - Health financing - Inspection & follow up - Health education - Drugs & medical equipment - Quality assurance & patient health expenditures	- Health Information Center (HIC) - National Center for Disease Control (NCDC). - National Council for Medical Responsibilities (NCMR) - National program for organ transplantation (NPOT). - Libyan board for medical specialties - Medical Supply Organization (MSO) - Center for human resource development - Authority for ambulance services - Hospitals and medical centers - Directorates of health services at the municipality level

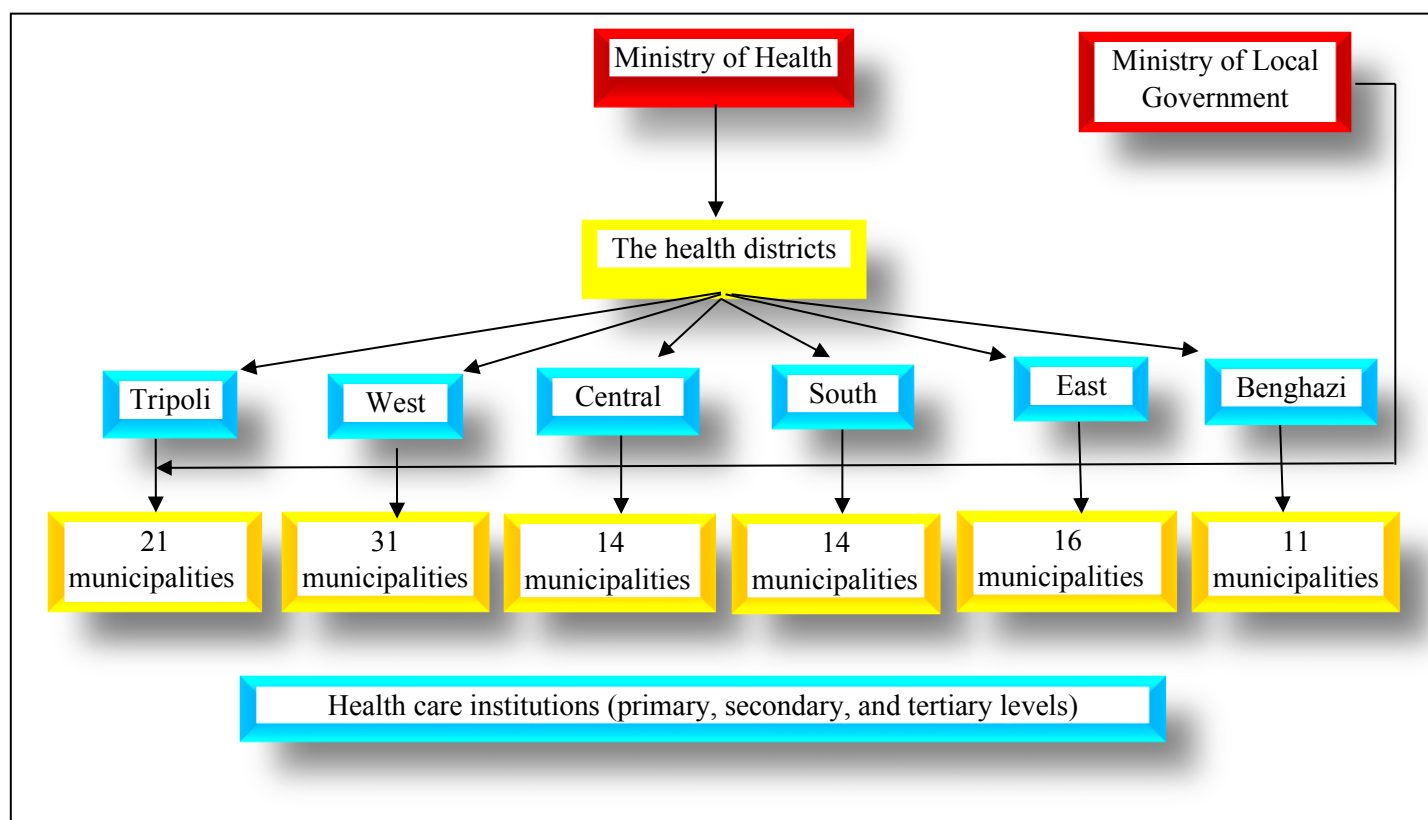
Source: Based on the organizational structure of the Libyan Ministry of Health (2017) (see Appendix Q)

These institutions, directorates, and offices are responsible for managing, organizing, planning, and coordinating health services throughout the country.

Figure 8 shows the administrative hierarchy of the health system at the local level. The Ministry of Regional Government assumes some responsibilities in the health system for the municipalities spread across the regions, such as evaluation, monitoring, data collection, and participation in planning. It is also the responsibility of municipalities to support and provide some services to health institutions located within their jurisdiction, but they do not receive funding for this purpose (Shalek & Al-Tajouri, 2021). In coordination with local authorities, health officers in the six health zones are responsible for coordinating the delivery of health services and other health-related aspects in their areas (Shalek, 2021).

Figure 8

Health system administrative chain



Source: Health regions and municipalities in accordance with Resolution No. 1352 of 2018

4.4 Structure of Libyan Health System

In Libya, rather than a totally state-run model, there is a hybrid system of public and private health care.

4.4.1 Public Sector

In urban and rural regions, health care is provided through a network of primary health care units, centers, polyclinics, rehabilitation centers, and general hospitals, as well as a handful of tertiary specialized care facilities. According to the WHO et al. (2017), the Libyan health-care delivery system is divided into three levels, as follows.

4.4.1.1 Primary health care

Primary health care is provided in a decentralized manner through 1,559 health institutions distributed across various geographical regions of the country according to population density, and it is classified into several categories:

- Primary health care units (PHCUs) provide curative and preventive services through 728 public health care facilities for populations ranging from 5,000 to 10,000 individuals. Services include maternal health care, neonatal and child health, school health and immunizations, early diagnosis of infectious diseases and implementation of local control measures, health promotion, registration and follow-up of chronic diseases, and others.
- Primary health care centers (PHCCs) provide services for populations ranging from 10,000 to 26,000 citizens. There are 571 centers that provide different curative medical and dental services for walk-in patients and those referred from affiliated PHCUs (WHO et al., 2017).
- There are 56 polyclinics that provide specialized curative services, including dental care, and contain laboratories, radiology services, and pharmacies. They receive walk-in

patients and those referred from affiliated PHCUs and PHCCs. In addition, they offer maternal and child health, school health, and nutritional awareness. These clinics serve approximately 50,000 to 60,000 citizens (WHO et al., 2017).

- The National Centre for Disease Control (NCDC) is a specialized center that contributes significantly to enhancing public health and health protection for citizens, especially regarding disease prevention and control, in cooperation with corresponding specialized centers such as the WHO and other relevant international organizations and institutions (NCDC, 2023). The center is responsible for developing the necessary plans and programs to prevent and combat tuberculosis and other chest diseases, HIV and other communicable, endemic, and chronic diseases, and supervising the implementation of those plans through appropriate vaccines and mechanisms for their distribution (NCDC, 2023). The center operates through 36 branches distributed in various cities in order to implement plans, programs, and activities related to the center's specializations within the geographical scope of each branch (NCDC, 2023).
- Other types of facilities such as dental clinics, reference laboratories, diabetes treatment and follow-up centers, ambulance services centers, etc.

4.4.1.2 Secondary health care

At the secondary level, there are general hospitals in both rural and urban locations that give care to patients referred from the first level. There are two types of hospitals that provide healthcare at the secondary level. Until 2017, there were an estimated 48 general hospitals with more than 100 beds, and these hospitals provide various specialty health care, including dental care for patients referred from the primary health care facilities (WHO et al. 2017). There are also 27 rural

general hospitals with capacities ranging between 40 and 60 beds that provide health care in the fields of pediatrics, obstetrics, gynecology, general surgery, dental care, and general medicine.

4.4.1.3 Tertiary health care

At the tertiary level, there are 22 specialized and teaching hospitals that provide advanced care for people referred from the second level. They provide specialized inpatient services, such as chest care, cardiology, psychiatric, and eye care (WHO et al., 2017). In addition, in 2017, 64 health facilities with different capacities and specialties were upgraded and given “hospital” status. Table 6 shows the distribution of hospitals among health regions.

Table 6

Geographical distribution of hospitals across health regions

Category	Rural H	General H	Specialized H	New H	Total
Region	N (%)	N (%)	N (%)	N (%)	N (%)
East	06 (17.1)	07 (20.0)	00 (00.0)	22 (62.9)	35
Benghazi	04 (13.8)	08 (27.6)	08 (27.6)	09 (31.0)	29
Central	03 (16.7)	05 (27.8)	02 (11.1)	08 (44.4)	18
South	04 (23.5)	05 (29.4)	00 (00.0)	08 (47.1)	17
Tripoli	03 (11.1)	09 (33.3)	11 (40.7)	04 (14.8)	27
West	07 (20.0)	14 (40.0)	01 (02.9)	13 (37.1)	35
Total	27(16.8)	48(29.8)	22(13.7)	64(39.8)	161(100)

Source: WHO et al. (2017)

4.4.2 Private Sector

According to the LMoH (2019), Libya has 235 private inpatient institutions with a total capacity of approximately 4,200 beds. Most private facilities are concentrated in major cities such as Tripoli, Benghazi, Aljafara, and Misrata. There are also 537 outpatient clinics, 371 dental clinics, 3,098 pharmacies, and 411 laboratories in the private sector (LMoH, 2019).

The government encouraged the private health sector to expand health activities such as clinics, hospitals, family medicine practices, etc., and established legislative regulations that

allow these activities (Chapman, 2014). However, this sector initially faced obstacles due to the lack of a comprehensive approach to private sector policy by the Ministry of Health (WHO et al., 2017). In the absence of clear and consistent policies, private clinics generally faced uncertainty, making them reluctant to expand their investments and development. These clinics were granted licenses to operate without clear standards or inspection policies, leading their owners to fear that their licenses might be revoked by the authorities, thus affecting the healthy growth of this sector (WHO et al., 2017). Regarding employment, the private sector has relied on health professionals, especially doctors, working in the public sector who are attracted to this sector due to its higher wages (WHO et al., 2017). While a decree was issued in 2006 prohibiting dual employment, it was criticized for its negative effects on the health sector in general (Shalek & Al-Tajouri, 2021).

4.5 Health Insurance in Libya

Until the present time, health insurance services are considered very limited, and restricted only to workers in oil companies or some public institutions (Al-Muhair, 2023). Most citizens do not have health insurance, which has made the cost of treatment burdensome, especially after the spread of private health institutions such as clinics, pharmacies, analysis centers, etc., to which residents usually resort as an alternative to the public sector (Shalek & Al-Tajouri, 2021). It should be noted that the General Health Insurance Fund (GHIF) was established pursuant to Main Council Resolution No. 854 of 2017 to provide health insurance services to all Libyans (GHIF, n.d.). The pilot work for the Fund began in 2022 in the city of Tripoli, targeting retirees through an electronic database or through the personal presence of the member (GHIF, n.d.). In 2023, the actual work of this fund began by resuming the registration of the first tranche on a large scale by opening several centers for registration and issuance of medical insurance cards in various health regions (Libyan News Agency, 2023). The Fund has

developed a plan that aims to resume the registration of all citizens with this service, as the population has been classified into several segments to be successively registered in the system. According to the plan, this service is projected to cover all segments by the end of 2025 (GHIF, n.d.).

4.6 Indicators of Health System Components

The provision of public health services depends on several main components, including the density of the physical presence of health institutions, manpower, financing, equipment, and others.

4.6.1 Health Facility Density

Health facility density is one of the indicators used by the WHO to evaluate the efficiency of health systems in providing their services. Health facility density is calculated as the density of health services per unit population. The WHO has set the density rate for the number of health institutions as two health facilities per 10,000 people. However, in Libya, according to the WHO et al. (2017), the density rate of health institutions was 2.8, exceeding the required rate despite the state of instability that Libya experienced at that time. The study also indicated that Libya's health facility density is a strong asset for the delivery of current and future health services, since the number of hospital beds eventually reached 37 per 10,000 people, which is higher than the World Health Organization standard of 26 per 10,000 people.

4.6.2 Maternity Bed Density

Maternity bed density (per 1,000 pregnant women) provides an indicator of access to maternity services. The indicator does not include birthing beds. For every 1,000 pregnant women, the World Health Organization recommends 10 maternity beds. The World Health Organization's survey served as the basis for calculating this indicator, which only applies to

public health facilities. The density of maternity beds in Libya was found to be 13 maternity beds per 1,000 pregnant women, indicating that the international standard was being met at the national level.

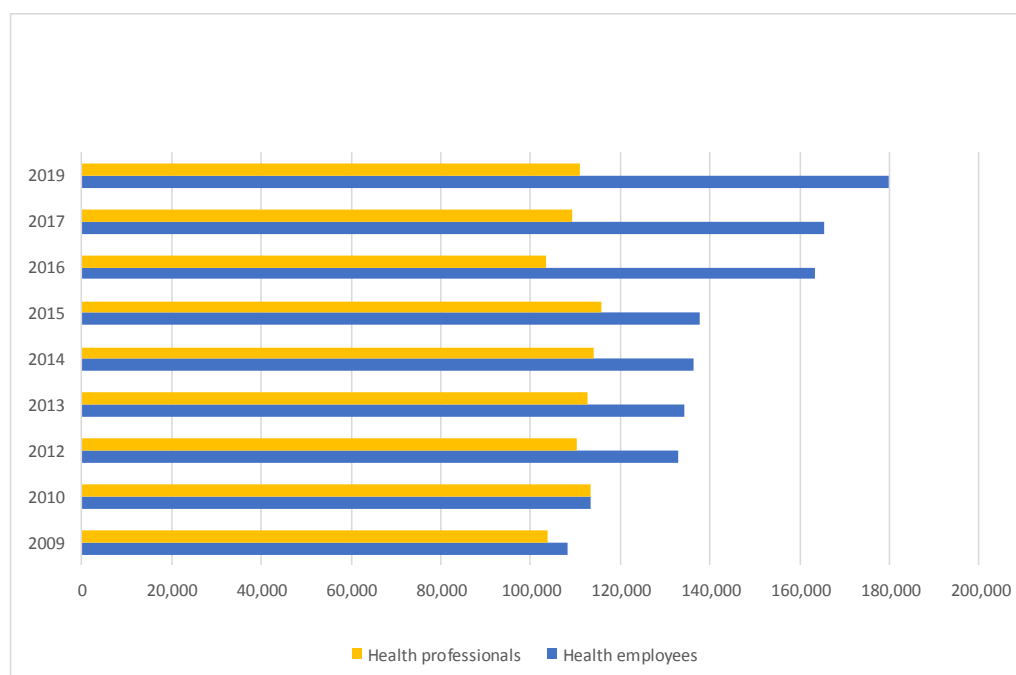
4.7 Health Workforce

According to the annual report by the LMoH (2020), the workforce in all health facilities and departments in the regions and their affiliated entities is estimated at approximately 211,073 people, which constitutes 8% of the total workforce in the country. The Libyan Organization of Policies and Strategies (LOOPS) (2017) indicated that the volume of employment in the health sector increased significantly after the 2011 Libyan revolution, without restricting the employment standards of the Libyan Employment Law of 2010. The deterioration of the security conditions in the country after 2011 prompted most foreign workers to leave the country, including workers in the health sector, which is estimated at 20% of the workforce in the sector, and to fill this gap, the door has been opened to employ new workers (Al-Talg, 2021).

The Ministry's annual report also indicated that the total number of workers in the health sector and the health district office for the year 2009 was estimated at approximately 108,427, while the number of health professionals reached 103,734. Later, the total number for the sector's workforce reached 179,684 in 2019, of whom 110,872 were health professionals. Most of this increase in the number of workers was in other specialties, whether in health institutions and health affairs departments in the regions, as shown in Figure 9.

Figure 9

Development of the workforce in the Libyan health sector during the period 2009–2019



Source: Based on the data contained in the annual reports of the Ministry of Health

4.7.1 Health Workforce Structure

Table 7 shows the structure of the workforce in health institutions for health professionals for the year 2019. It is clear from the table that the percentage of nurses and health technicians is the highest, as they constitute more than 75% of the total number of health professionals, while the percentage of pharmacists was 4%, and did not exceed 1% for midwives for the total number of health professionals.

Table 7*Medical and technical staff in public health facilities for the year 2019*

Specialization	The total	(%) Percentage of total
Physicians	15,265	14
Dentists	5,834	5
Pharmacists	4,151	4
Nursing	45,333	41
Midwifery	1,095	1
Health technician	39,194	35
Total	110,872	100%

Source: Based on the annual reports of the Ministry of Health

4.7.2 Health Workforce Density

In order to achieve adequate coverage for the main primary health care interventions, the international standard for the density of health sector workers is 23 per 10,000 people, while in Libya this rate reached 67 per 10,000 people, which is almost three times higher (WHO et al., 2017). By analyzing the components of the work intensity index per 10,000 people in Libya and comparing them to some countries in the region, as shown in Table 8, we find that in 2018 the number of doctors in Libya reached 22.9, dentists reached 8.8, and pharmacists reached 6.2, which are close to the rates of the region's other countries, while the largest percentage was for the segment of nurses and midwives, which was 68.8 per 10,000 people, which indicates that the increase in the volume of employment has been more concentrated in this segment, and specifically in nursing, because as mentioned above, the percentage of midwives does not exceed 1% of the total health professionals in Libya. At a time when some health institutions lack a sufficient number of health professionals, including nurses and midwives, this also indicates poor distribution (Shalek & Al-Tajouri, 2021).

Table 8

Comparing the density of workers in the Libyan health sector and some countries in the region

Country	Rate (R) per 10,000 population				Year
	Physicians (R)	Dentists (R)	Pharmacists (R)	Nursing and midwifery (R)	
Jordan	23	7.2	13.1	33.2	2013
Bahrain	22.6	3.7	5.4	45.4	2012
Tunisia	13	3.1	2.3	38.9	2013
Libya	20	6	6	67	2012*
Libya	22.9	8.8	6.2	68.8	2018
Iran	15.4	4	3	12.3	2013
Syrian	11.7	6.8	9.6	14	2012
Oman	21	2.3	5.9	44	2013
Kuwait	25.3	3.1	6.9	67.2	2012
Lebanon	31.2	15.6	19.8	37.4	2013
Egypt	8.2	2.1	4.9	15.5	2013
Morocco	6.7	1	2.6	8.5	2013
Saudia Arabia	26.4	5	8.7	55.2	2013

Sources: Libyan Ministry of Health Annual Statistical Report (2019)

* Libyan Ministry of Health Annual Statistical Report (2014)

4.8 Training and Qualifications in The Health Sector

Mishra (2020) indicated that training is an investment in human capital and an enhancement of intellectual assets in institutions. Mishra (2020) also added that it contributes to developing the capabilities of employees and their readiness to work proficiently, achieving the quality to give an organization a competitive advantage among other institutions. Hence, training programs should be adopted that suit the needs of employees. Also, training employees on the latest scientific developments in the institution's field of work, whether medical, technical, or

informational, ensures the development of this institution and allowing it to keep pace with global progress in its field (Ba Uwain & Abd Wahab, 2023). Here, the employment indicator or number of employees alone is not sufficient to obtain appropriate coverage of quality health services, since employee qualifications comprise one of the most important indicators that reflect the extent of interest in the human element and its readiness for current and future work (Ba Uwain & Abd Wahab, 2023)

In this regard, the Medical Manpower Development Center (MMDC) of the Libyan Health Ministry is the body responsible for training and qualifying health sector employees. The center provides various training courses for sector employees through the main center located in Tripoli and eight other branches distributed in various regions (MMDC, n.d.). Table 9 was prepared from the information contained in statistical reports on the center's activity, and it summarizes the number of employees who received training courses annually during the period from 2007 to 2020. The table shows that the number of employees who take training courses varies from year to year. For example, in 2013, the number of trainees reached 4,729 employees, while a significant decline was recorded in subsequent years, as the number of trainees at the sector level reached only 636 employees in 2019.

Table 9

Number of employees who received training courses during the period 2007–2020.

Year	Number of trainees
2007	1731
2008	857
2009	1204
2010	2426
2011	632
2012	1948
2013	4729
2015	439

2016	274
2018	1490
2019*	636
2020*	672
Total	17038

Sources: Libyan Ministry of Health (2018) Annual Report

* Libyan Ministry of Health (2020) Annual Report

The percentages of employees who received training courses are modest compared to the total number of employees in the sector and does not exceed 8% of total employees. There has also not been a noticeable increase in the number of trainees in recent years to match the increase in the volume of employment, which indicates a deficiency in developing programs to qualify newer workers.

4.9 Health Spending

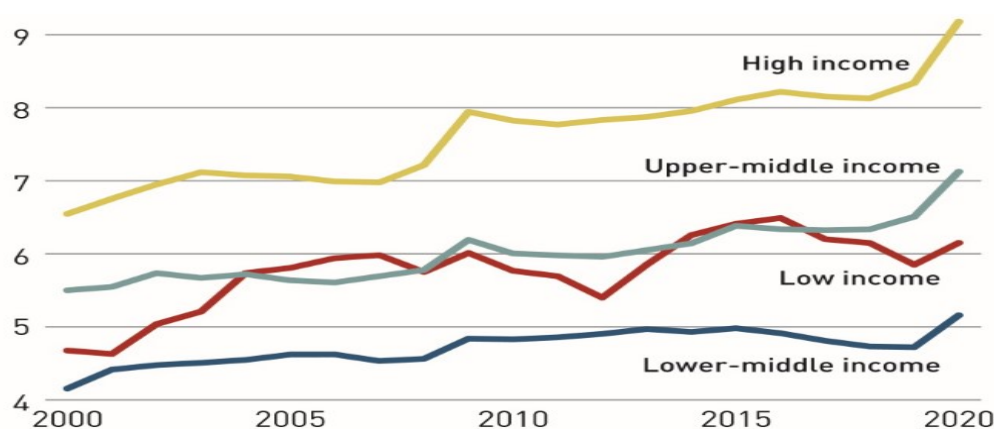
Health spending constitutes one of the most important elements in the success of a health system by covering operational costs, medicines, medical and technological equipment, establishing and maintaining health institutions, and so on (Tandon & Reddy, 2021). The percentage of health spending as a percentage of a country's gross domestic product is usually used to indicate the priority a country gives to its health system (Shalek & Al-Tajouri, 2021). The goal of increasing government spending is to ensure equal access for all residents to health services without impoverishing them, and to achieve this goal, the use of the money must be carefully planned. In the words of the Director-General of the WHO (2019):

Increased health spending is essential for achieving universal health coverage and the health-related Sustainable Development Goals, but health spending is not only a cost; it's an investment in poverty reduction, jobs, productivity, inclusive economic growth, and healthier, safer, fairer societies (n.d).

Figure 10 shows that the percentage of health spending out of GDP in most countries in the world has increased significantly over the past decade, and especially after the coronavirus pandemic, being recorded at 10% for most high-income countries, while the percentage of spending in middle- and upper-middle-income countries ranged from 6 to 7%, and did not exceed 5.5% in low-income countries.

Figure 10

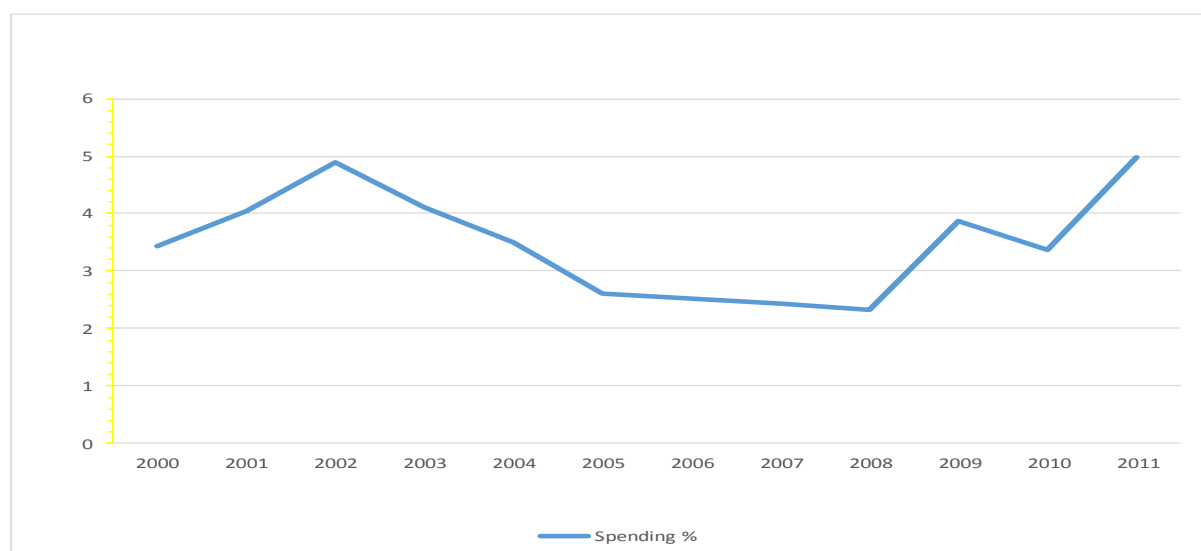
Global health spending as share of GDP (%)



Source: WHO report (2023)

4.9.1 Spending on Health Sector in Libya

The percentage of what Libya spent out of its gross domestic product on the health sector until the year 2011 did not reach 5%, as shown in Figure 11, which is less than the average of what was spent by the upper-middle-income group, which includes Libya. Due to the lack of data for this indicator for the rest of the years, the expenditure value was used to obtain an adequate picture of health spending in Libya.

Figure 11*Libyan Health Expenditures: % of GDP 2000–2011*

Source: World Bank (2022)

The circumstances that Libya has experienced since the 2011 revolution and the resulting proliferation of weapons, power struggles, and armed clashes that extended for about ten years greatly increased the demand for health services (Al-Talg, 2021). These armed confrontations had a major impact on the country's infrastructure and caused losses to public and private property. Many health facilities were damaged as a result of these clashes, and a large number of them stopped working completely as a result of the lack of security and the difficulty of access for employees, in addition to the general lack of medical supplies, including medicines and operating materials (Saieh, 2021). Also, the political division that has occurred in Libya since 2014 and the emergence of two governments in the country, i.e., one in the east and one in the west, and the resulting division of state institutions have made the responsibility for managing the health sector more difficult (Al-Talg, 2021). Al-Talg (2021) added that internal conflicts and government negligence have left the Libyan health care system in a state of near-collapse.

According to the WHO et al. (2017):

At the time of the survey, 17 hospitals (18%), 273 primary health care facilities (20%), and 18 other specific health services (8%) were closed. The Benghazi region was most affected in terms of health facility closures as a result of ongoing conflict.

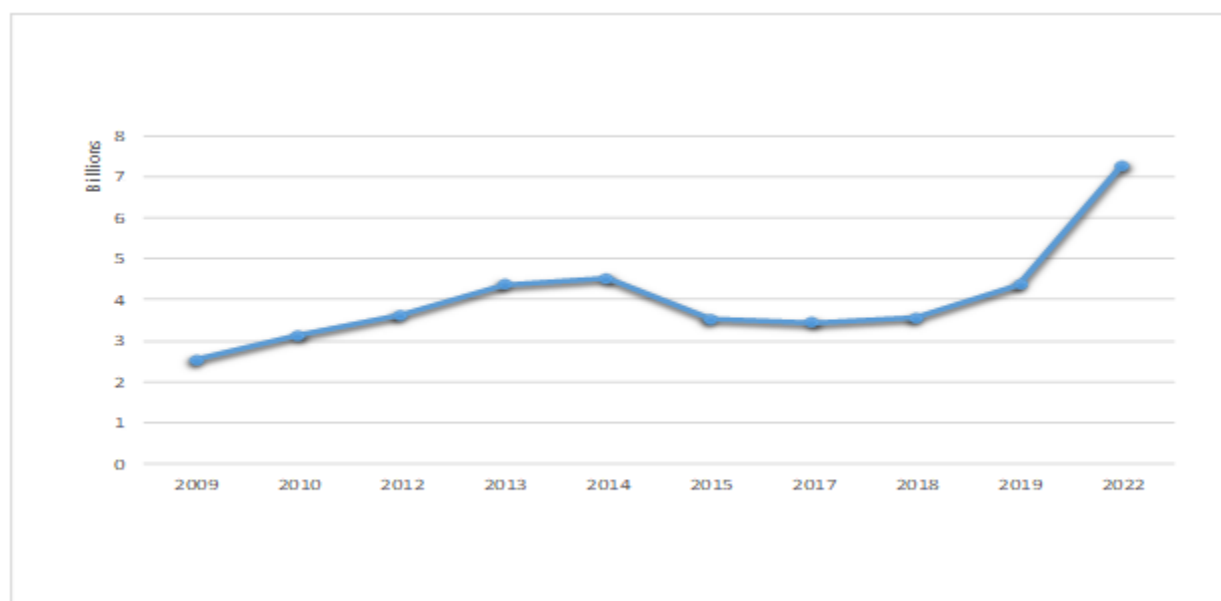
The country in general also faced other challenges related to the interruption of electrical power for long periods due to the destruction of infrastructure and a severe shortage of fuel, which directly affected all economic activities in the country, but especially the health sector. The coronavirus pandemic that the world has witnessed since 2019, which reached its peak in Libya in 2021, has increased the pressure on this sector (Saieh, 2021). These factors revealed the sector's weakness in the face of crisis, which has prompted successive governments to increase spending on health in an attempt to improve its services in the absence of a clear vision or strategy.

Since 2020, the country has witnessed a kind of stability following the ceasefire agreement in Geneva under the auspices of the United Nations and the installation of a national unity government for the country in 2021, supposedly ending the state of division (UN, 2023). However, after several months, another parallel government re-emerged in the western part after the National Unity Government failed to organize elections on time by the end of 2021, bringing the country back to square one (UN, 2023). It should be noted that in the years since the National Unity Government took over administration of the country, a significant improvement has been observed in the security situation, which has allowed state institutions to return to work and overcome most of the challenges that the country faced, including providing fuel and cash liquidity in banks, maintaining and repairing the state's most important vital facilities, and the gradual return of electrical power (Al-Arab, 2023).

Figure 12 shows that the amount of spending on this sector increased in the years after 2011, and that the spending amounted to about 5 billion dinars in most years until it passed 7 billion dinars in 2022, with amounts spent on major items such as salaries, operational expenses, medicines, and maintenance being estimated at three times what they were in 2010.

Figure 12

Libyan Healthcare Expenditures (billion dinars) 2009–2022



Source: Based on the data contained in the annual reports of the Ministry of Health, the budget law for different years and Central Bank of Libya. (n.d.).

There is also a significant lack of information for some years such as 2011, 2017, and 2020, in which the country witnessed violent armed confrontations and the cessation of work on a large scale by state institutions. However, there are other amounts that did not appear in the Ministry of Health reports, such as the transition budget for some years (LMoH, 2019), and other amounts that were not included in the health budget such as expenditures on the coronavirus pandemic, which were included under the emergency item budget (Libyan Audit Bureau 2020).

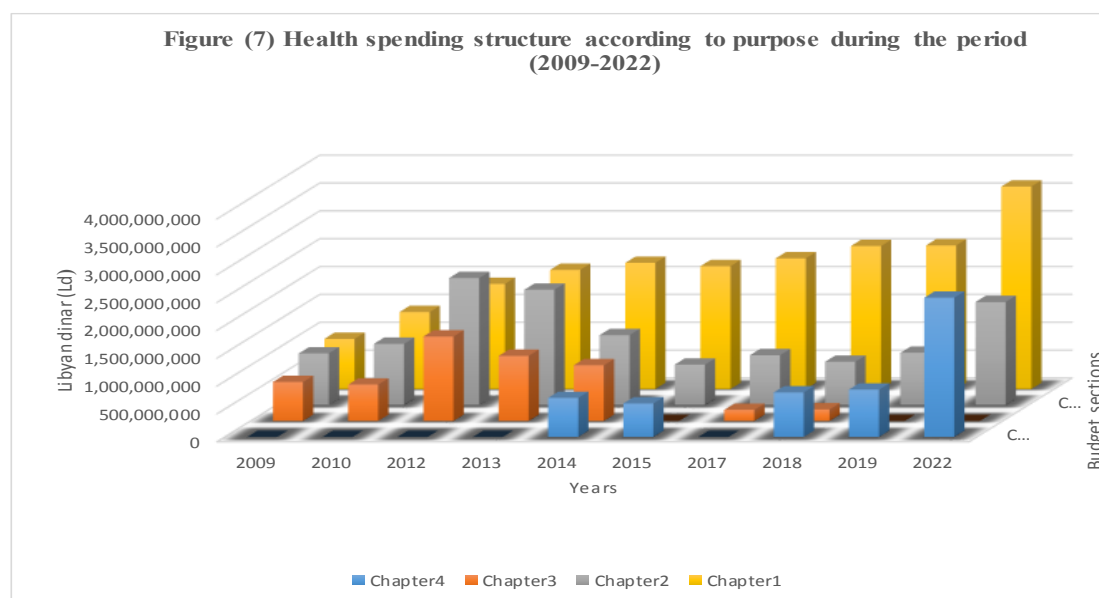
4.9.2 Structure of Libyan Health Spending

The Libyan Law No. 12 of 1986 stipulates that the budget be divided into two main parts: the first is allocated to revenues, and the second to expenses. The part related to expenses is divided into five chapters: 1) Wages; 2) Operational expenses; 3) Developmental projects and programs (investments); 4) Subsidies such as subsidies for goods and services for some sectors only; and 5) Extraordinary or emergency financial arrangements. On this basis, the budget is transferred to the Ministry of Health and all its affiliated bodies, such as health institutions and facilities, which are estimated to total approximately 350 institutions, each having its own independent financial management structure. While the disbursements come according to pre-determined terms, they are subject to financial laws and legislation.

By analyzing the structure of health spending, it is possible to identify the chapters in which spending is concentrated. It is clear from Figure 13 that the health sector, especially in recent years, has focused on the first chapter, which is devoted to wages and salaries.

Figure 13

Health spending structure according to purpose during the period 2009–2022



Source: Based on the data contained in the annual reports of the Ministry of Health, the budget law for different years and Central Bank of Libya. (n.d.).

Although Chapter Two is allocated to administrative and operational expenses, including medicines and medical equipment, since 2014, spending for these has also begun to increase in Chapter Four (allocated for support) in an attempt to compensate for the shortage of these materials in health institutions, which has made this item expand significantly in recent years. However, there was a significant shortage in the part of budget allocated for new projects and development (Chapter 3). This indicates that throughout the last decade, the focus was on consumer spending and neglecting investment spending, meaning that the goal was to restart the sector and provide the main requirements for medicines and operating materials, in addition to repairing the damage caused to the sector as a result of armed confrontations. This is logical because the state of security and political instability that Libya experienced did not allow for the construction and development process.

In this regard, it is worth noting the criticisms directed at this sector, such as those contained in the Libyan Audit Bureau's reports for the years 2012–2022, which reveal repeated observations over the years about the Ministry of Health and its affiliated bodies not adhering to financial and accounting controls, causing the waste of public money, and other factors revealing mismanagement of this sector and administrative and financial corruption. The Audit Bureau's report for the year 2021 in this regard stated that despite the significant increase in the volume of spending, health services did not improve. This indicates that the health sector in Libya does not lack financial resources so much as it lacks efficiency in managing these resources.

4.10 Health Information System

A properly functioning health information system (HIS) has been stated to be the cornerstone of an effective and equitable health care system (Shalek & Al-Tajouri, 2021), and

the lack of a robust and effective HIS often results in a significant gap between what policymakers, health professionals, and researchers know and what they need to know in order to improve the health of the population. According to the WHO (2008), a health information system involves "the generation of information to enable decision-makers at all levels of the health system to identify problems and needs, make evidence-based decisions on health policy, and allocate scarce resources optimally" (p. 3). In this context, most developed countries have invested in data collection mechanisms, relying on electronic health applications and training workers to use them, which has helped their health systems obtain information that helps decision-makers make sound decisions to improve health services (WHO, 2008). In contrast, health systems in many low- and middle-income countries, including many countries in the Arab world, are characterized by weak health information systems, which reduces their ability to address existing challenges and monitor system performance in a timely manner (WHO et al., 2017).

According to the EU et al. (2017), the data collection system in Libya before 2011 relied on 23 sub-centers responsible for collecting data from various health units, classifying it, and transferring it to the Ministry of Health via electronic reporting. Although there were significant gaps in information collection and transmission, data on disease burdens, service use, and outcomes were somewhat available. The central level was responsible for using the data received to publish annual reports on health indicators (EU et al., 2017). However, after 2011, this mechanism suffered as a result of the difficulties faced by a large number of hospitals, health centers, and data collection centers in performing their work, causing a data shortage for some years (Shalek & Al-Tajouri, 2021). The study conducted by the WHO et al. (2017) indicated in its evaluation regarding data collection systems in health facilities that staff and infrastructure in

Libya were sufficient to prepare reports manually, but that access to computers and the Internet was limited to 36% of hospitals, and only 28% of hospitals used computers to keep records. Another challenge facing the Libyan health information system is the lack of training of experts in information offices, hospitals, and provincial health departments (EU et al., 2017). Although the World Health Organization supported the Ministry of Health in strengthening the comprehensive civil registration and vital statistics system, there is still a need to build capacity (Shalek & Al-Tajouri, 2021).

Despite the challenges, there have been efforts since 2018 to develop the Libyan health information system by building an electronic platform to collect health information. Since that time, the Information and Documentation Center at the Ministry of Health, in partnership with the World Health Organization, UNICEF, and the International Organization for Migration, has begun a series of workshops on capacity-building to benefit from the District Health Information System (DHIS2) and develop plans to implement this system (WHO, 2023). The DHIS2 is an open-source, web-based health information management system that captures aggregate data (e.g., routine health facility data, staffing, equipment, infrastructure, population estimates) and event data (disease outbreaks, survey/audit data).

To enable decision-makers to easily use these analyses through tables, charts, maps, etc. generated by the system (WHO 2023), the Information and Documentation Center has worked to implement this strategy for developing the health information system, providing many training courses for workers to enable them to use the platform (Information and Documentation Center, 2023), which has already been launched and registered under the domain name www.dhis2ly.ly. The Ministry of Health also concluded an agreement in 2023 with the Libyan Al-Madar Telecommunications Company to allocate cloud space on which health data is stored. The Center

added that it has become able to issue annual reports based on this platform and provide health indicators to international organizations, especially the World Health Organization. It is also possible to access health reports for various years from 2005 to 2020 through the official website of the Health Information Center at the Ministry of Health, at <https://seha.ly/reports/center/>.

Chapter Summary

The geographical and demographic nature of Libya requires a strong health system, but the limited population and its wide distribution across this vast geographical area, which shares borders with several countries, make the health system's task of providing high-quality health services more difficult.

In this chapter, we pointed out the main elements that a health system must have in order to be able to provide high-quality health services for all members of society. By applying these requirements to the Libyan health sector, we find that there is much work needed to achieve the necessary standards, given the problems the sector suffers from. Below is a summary of the findings of this chapter:

- Following World Health Organization standards, Libya has a robust infrastructure that consists of a series of health facilities at various levels that are capable of offering suitable medical care in various geographical locations.
- The Libyan Ministry of Health is the body legally responsible for managing the health sector, both public and private, including developing policies and programs to provide and develop health services. This ministry has an organizational structure consisting of a number of offices, departments, and centers to conduct this work in coordination with the municipal health district administrations affiliated with the Ministry of Local Government. Health services in the public sector are provided free of charge, while health insurance is limited and not widely used.

- The health sector also suffers from some structural problems, perhaps the most important of which are related to the large increase in the number of jobs for nurses and administrators, while there is a shortage in some other fields such as doctors and midwives. There is also a notable lack of training and qualification programs for workers in the sector, while there are budgeted financial allocations for this purpose that have not been exploited for some years, which indicates a deficiency in developing plans to raise the efficiency of workers in the sector (The Audit Bureau Reports 2014).
- Regarding financial resources, the health sector does not lack financial resources so much as it lacks effective management to rationalize the spending of these resources. Mismanagement and weak oversight, follow-up, and accountability are among the main reasons for not utilizing these allocations properly and for the emergence of cases of corruption (Shalek & Al-Tajouri, 2021).
- The failure of the national Ministry of Health to adopt information technology to link its various health institutions, departments, and offices makes the job of managing this sector more difficult. Also, the use of e-health applications in the sector is limited, which was noted in the literature review as well.

Chapter Five: Data Analysis

This chapter provides analysis of data collected from the primary sources, and is divided into two sections, the first of which concentrates on scrutinizing the data gathered from the questionnaire, while the second delves into the analysis of data acquired from the interviews.

5.1 Part One: Questionnaire Analysis

This section provides a meticulous examination of data derived from the questionnaires in order to explore the behavioral patterns of employees within the targeted Libyan health institutions. Utilizing the Statistical Package for the Social Sciences (SPSS) version 29, the questionnaire was designed, based on the unified theory of acceptance and use of technology, to encompass six primary axes aimed at scrutinizing employees' behavior concerning the utilization of electronic health records. Additionally, the analysis incorporates demographic information and other pertinent data serving the research objectives.

Primarily, this examination entails the analysis of demographic data pertaining to the sample alongside other analyses, such as assessing computer proficiency and levels of familiarity with e-health applications. Subsequently, the process proceeds to multiple regression, which encompasses validation of the main assumptions inherent to Multiple Linear Regression, followed by the execution of that linear regression. This is followed by scrutinization of the statistical significance of the model, hypothesis testing, and interpretation of the results. Finally, the chapter concludes with the identification of proposed interventions based on the analysis.

5.1.1 Descriptive analysis

The following discussion analyzes the first part of the questionnaire results to describe the demographic distributions of the respondents and to show the differences between them.

Table 10 shows the demographic information of the sample participants for this research, 42% of whom were men and 58% were women. Nearly 29% of the respondents had 16 years or more of work experience, followed by 25% with 1-3 years of experience and 19% with 4-7 years. Lastly, the proportions of people with 8-11 and 12-15 years of experience comprised 13.2% each. According to the sample's age distribution, respondents between the ages of 31 and 40 made up 47.8% of the sample, while those under 30 and those between the ages of 41 and 50 made up roughly 26% and 17%, respectively. Meanwhile, only 9% of the participants were between the ages of 51 and 60. Physicians constituted about 46% of the sample, followed by health professionals at about 20%, nursing with 18%, and administrators with 16%. Regarding education, those with a bachelor's degree made up 51% of the sample population, those with intermediate and higher diplomas made up 19% of the population each, and those with a master's degree or higher made up 10%. The data also revealed that 55% of the sample was fluent in English.

Table 10*Demographic data of the sample*

Variables	Categories	Frequency	Percent %
Age	30 years or less	36	26.5
	31 - 40	65	47.8
	41 - 50	23	16.9
	51 - 60	12	8.8
	Total	136	100
Gender	Male	57	41.9
	Female	79	58.1
	Total	136	100
Experience	3 years or less	34	25.0
	4 - 7 years	26	19.1
	8 - 11 years	18	13.2
	12 - 15 years	18	13.2
	16 years or more	40	29.4
	Total	136	100
Job	Doctor	62	45.6
	Health professional	27	19.9
	Nursing	25	18.4
	Administrative	22	16.2
	Total	136	100
Education level	Intermediate Diploma	26	19.1
	Higher Diploma	26	19.1
	Bachelor's degree	70	51.5
	Master's and above	14	10.3
	Total	136	100
English language proficiency	Not at all	13	10.0
	Intermediate	48	35.0
	Upper intermediate	53	39.0
	Advanced	22	16.0
	Total	136	100

5.1.2 E-Health awareness

The questionnaire also included three Yes or No questions targeting the extent of each participant's knowledge and awareness of various aspects of e-health, as follows. The first question focused on theoretical knowledge: Do you have previous theoretical knowledge about the EHRs (such as their importance, function, and the opportunities that they may achieve)? Meanwhile, the second question focused on practical knowledge such as training: Have you ever been trained to use an EHR system or any e-health application? Lastly, the third question focused on practical experience: Have you ever been experience operating or using an EHR system or any e-health application? Table 11 shows the responses obtained to answer these questions. It is clear from the data that 43% of the sample did not have any idea about e-health, while only 17% had received training on at least one E-health application, and the percentage of those with practical experience with electronic records did not exceed 14% of the sample size.

Table 11

Knowledge and Awareness of E-Health

Responses	Theoretical knowledge		E-health training		Operating experience	
	Number	%	Number	%	Number	%
No	59	43 %	113	83 %	117	86 %
Yes	77	57 %	23	17 %	19	14 %
Total	136	100 %	136	100 %	136	100 %

The analysis also indicates that only 25% of doctors and 8% of nurses had practical experience using an e-health application, while the percentages for health administrators and technicians did not exceed 5% or 4%, respectively (See Appendix S).

5.1.3 Self-efficacy in using computers

Competence in using a computer is one of the factors used to predict the extent to which people will be able to use new technology, and the more experience a person has in using computers, the greater the possibility of accepting the use of new technology. Individuals' familiarity with using computers, as evidenced by cumulative length of time, can influence their self-efficacy and acceptance of new technology (Durodolu & Olumide, 2016). Moreover, acquiring computer skills can enhance self-efficacy and facilitate the acceptance and effective use of new technologies in different work environments.

5.1.3.1 *Period of computer use*

Period of computer use is one of the indicators used to determine a person's familiarity or attachment to using the computer and can thus reflect the person's work environment. Table 3 shows the respondents' reported self-efficacy in using computers. Period of computer use indicates the level of familiarity with using computers, with a higher percentage of daily and weekly users indicating greater comfort and experience with using this technology. From the data, it can be seen that 32% of the sample was not accustomed to using a computer.

Table 12

Period of computer use

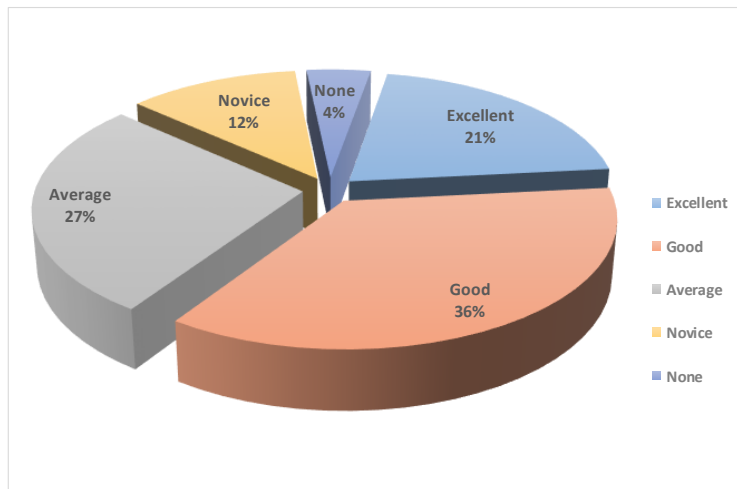
Period of use	Sample ratio
Daily	37 %
Weekly	31 %
Monthly	20 %
None	12 %
Total	100 %

5.1.3.2 Ability to use a computer (computer literacy)

Figure 14 depicts the distribution of computer skill levels among the sample. The percentages of individuals reporting excellent and good computer skills suggest higher levels of self-efficacy and ability to use new technology. In contrast, individuals who consider themselves average or lower in computer skills may require more support and training to enhance their self-efficacy and adapt to new technologies.

Figure 14

Computer skills



5.1.4 Structure of the multiple linear regression model

Based on the unified theory of acceptance and use of technology, the information gathered will be used in this case to comprehend the behavioral intentions of employees toward accepting and using technology, as well as the influencing factors. Using a multiple regression model, the effect of the independent variables on the dependent variable can be determined, and this relationship can be expressed by the following equation:

Behavioral intention (BI) $\rightarrow$ Actual use of EHRs

$$BI = f(PE, EE, SI, FC, ANX) + e$$

$$BI = \beta_0 (PE) + \beta_1 (EE) + \beta_2 (SI) + \beta_3 (FC) + \beta_4(ANX) + e$$

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ Parameters of the regression equation that must be estimated from data.

Dependent variable: (BI) Behavioral intention

Independent variables:

- (PE) Performance Expectancy
- (EE) Effort Expectancy
- (FC) Facilitating Conditions
- (SI) Social Influence
- (ANX) Anxiety
- (e) is the model's random error (residual) term.

5.1.4.1 The study's hypotheses

The regression model is concerned first with determining whether there is a relationship between the variables (dependent and independent) by testing the following hypotheses:

First: The null hypothesis:

$$H_0: B = 0$$

The regression is not significant between the variables (there is no effect of the independent variables on the dependent variable).

Second: The alternative hypothesis: $H1: B \neq 0$

The regression is significant between the variables under study (there is an effect of the independent variables on the dependent variable), which can be expressed as follows:

H1: Effort Expectancy (EE) has a significant influence on Behavioral Intention.

H2: Performance Expectancy (PE) has a significant influence on Behavioral Intention.

H3: Social Influence (SI) has a significant influence on Behavioral Intention.

H4: Facilitating Condition (FC) has a significant influence on Behavioral Intention.

H5: Computer Anxiety (ANX) has a significant negative influence on Behavioral Intention.

5.1.4.2 Assumptions of Multiple Linear Regression

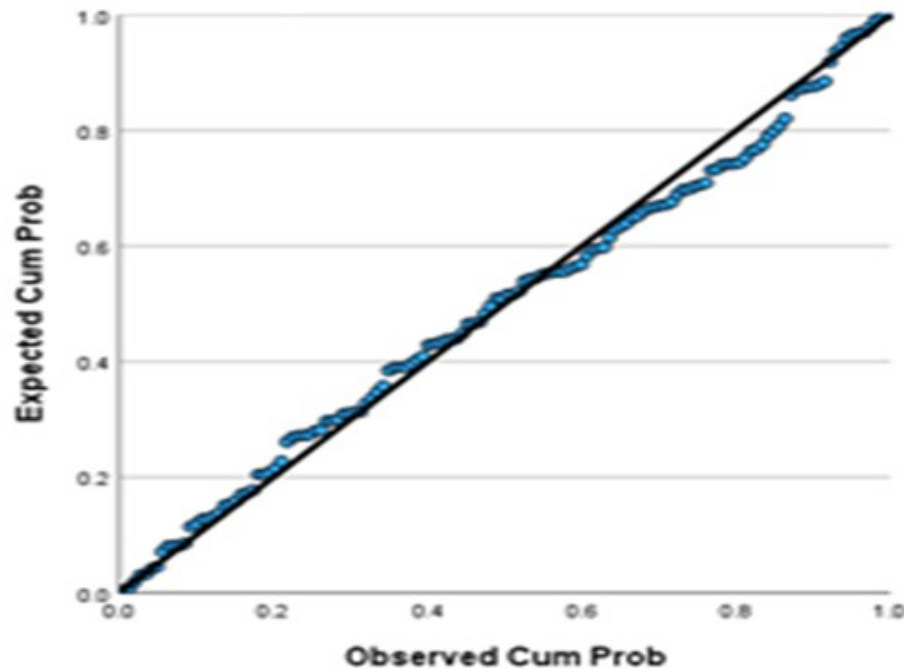
Before proceeding with the analysis of the model, we must first verify the possibility of the main assumptions of multiple regression. This is necessary in order to ensure the validity of the results obtained from the regression model, the most important of which are: linearity, homoskedasticity, independence of errors, normality, and non-multicollinearity (Hair et al., 2010).

5.1.4.2.1 Linearity

Linearity means that there must be a linear relationship between the dependent variable and the independent variables in order to conduct multiple linear regressions (Hair et al., 2010; Pallant, 2011). A graph can also be used to verify this assumption through scatterplots, whether they are linear or not (Hair et al., 2010). The assumption of linearity is fulfilled in Figure 15 below. Since there is no visible curvature, it is linear.

Figure 15

Regression-standardized residual

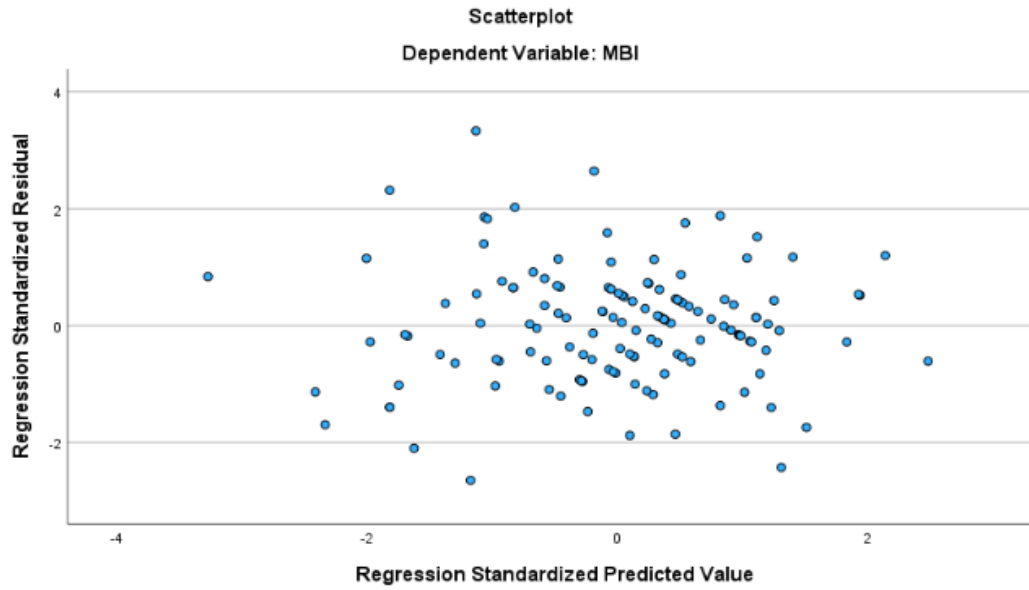


5.1.4.2.2 The residuals' variance is constant.

At every stage of the linear model, multiple linear regression assumes that the residual error amount is consistent, which is called homoskedasticity in this case (Hair et al., 2010). When reviewing the data, the analyst should plot the standardized residuals against the predicted values to ensure that the points are evenly distributed over all the independent variable values (Taylor, 2023). The SPSS program can be used to plot the data and create a scatterplot that contains the full model, which can be used to evaluate the assumption. Figure 16 clearly shows that the spread of the residuals is nearly equal at each level of the fitted values, demonstrating that the constant variance assumption is satisfied.

Figure 16

Regression standardized predicted value



5.1.4.2.3 Non-multicollinearity

Multicollinearity occurs when there is a significant correlation between independent variables. Therefore, there will be difficulty in determining which variables affect the variance of the dependent variable (Hair et al., 2010). The variance inflation factor (VIF) indicator can also verify this assumption.

According to Pallant (2011), the variance inflation factor (VIF) is simply the inverse of the tolerance value, where tolerance is defined as "the amount of the variability of the specified independent that is not explained by the other independent variables in the model" (p.158).

Based on the VIF and the tolerance test for each independent variable, it possible to ensure that there is no significant correlation between the independent variables because each variable must

be independent of the others. The VIF calculates the amount of inflation in the variance as a result of this collinear relationship, or what is also known as the standard error of the estimated regression coefficient. In generally, “a VIF above 4 or tolerance below 0.25 indicates that multicollinearity might exist, and further investigation is required. When VIF is higher than 10 or tolerance is lower than 0.1, there is significant multicollinearity that needs to be corrected” (Taylor, 2023).

Table 13

Multicollinearity Test

Variable	Tolerance	VIF
EE	.615	1.625
PE	.606	1.650
SI	.888	1.126
FC	.885	1.130
ANX	.764	1.308

$VIF = 1 / \text{Tolerance}$

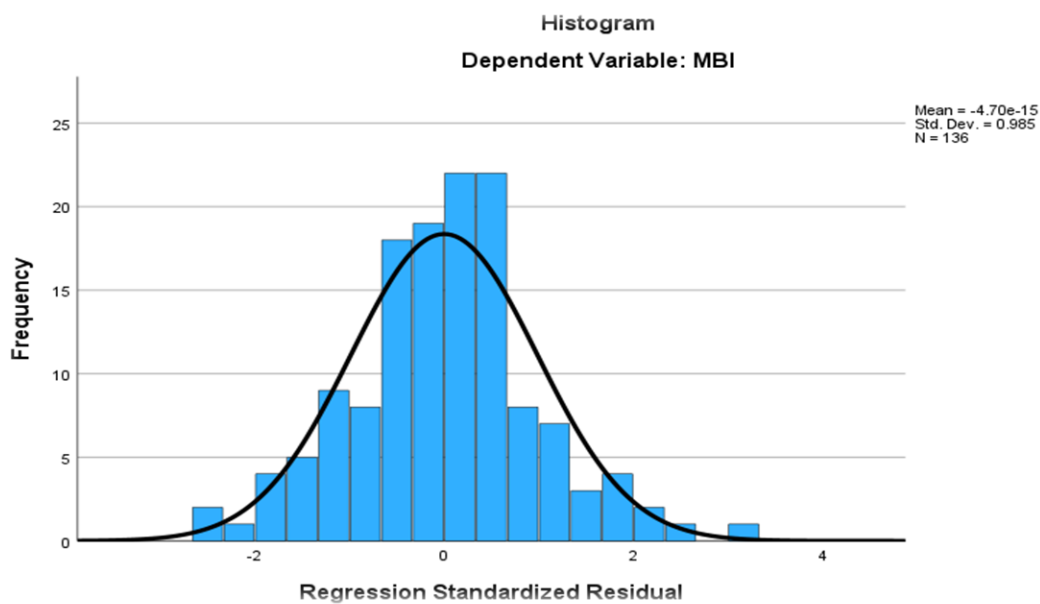
Table 13 shows that the variance inflation factor values for all independent variables are less than 4, with values ranging between 1.126 and 1.650. Where the Tolerance coefficient for each independent variable was greater than 0.25, it varied from 0.606 to 0.888. As a result, it can be concluded that there is no issue with multicollinearity between the independent variables.

5.1.4.2.4 Multivariate Normality

The definition of normalcy is predicated on the notion that the graphical distribution of the data is symmetrical and bell-shaped (Hair et al., 2010; Pallant, 2011). Many statistical tests need an evaluation of the data's normality, since parametric testing relies heavily on the assumption of normal data. The residuals of the regression, or the errors between observed and predicted values, must follow the normality distribution specification for the multiple linear regression analysis (Hair et al., 2010). Graphical verification is possible for this assumption. If the residuals do not exhibit skewness (bell-shaped), the assumption is met. Figure 17 demonstrates the moderation of the distribution and the fact that it conforms to the normality distribution. This assumption was also verified using a measure of kurtosis and skewness (see Appendix R).

Figure 17

Normality distribution of residuals



5.1.4.2.5 Independence of observation

The observations are supposed to be independent of each other, according to the model (Greene, 2012). In other words, the model implies that the residual values are independent, and the Durbin Watson statistic (DW) is used to verify this. The value of DW falls between 0 and 4, where: there is no autocorrelation when $DW = 2$; a positive serial correlation is indicated by $DW < 2$; and a negative serial correlation is indicated by $DW > 2$ (Greene, 2012). Generally, there may be a major autocorrelation issue if d is more than 2.5 or less than 1.5; otherwise, autocorrelation is probably not a reason for alarm if d is in the range from 1.5 to 2.5. In the model, $DW = 1.65$, as shown in Table 11 below, indicating no autocorrelation between the observations.

5.1.5 Statistical significance tests of the model

The significance of the model may be determined using the ANOVA table. The model is significant and explains the changes in the dependent variable because of changes in the independent variables, or one of them, if the value of (F) is significant at a p-value of 5% or less (Laerd Statistics, n.d.). Therefore, we accept the alternative hypothesis ($H1: B \neq 0$) and reject the null hypothesis ($H0: B=0$).

Table 14

ANOVA^a Table

Model	Sum of squares	df	Mean square	F	Sig
Regression	25.886	5	6.472	50.075	<.001b
Residual	16.930	131	.129		
Total	42.816	135			

a. Dependent Variable: BI

b. Predictors: (constant), SI, PE, FC, EE, ANX

Note from Table 5 that the value of (F) is (50.075), which reaches significance with a p-value of $< (0.001)$, which is less than the (0.05) alpha level. Thus, we reject the null hypothesis

($H_0: B=0$) and accept the alternative hypothesis ($H_1: B \neq 0$). The independent variables (or at least one of them) statistically significantly predict the dependent variable.

5.1.6 The model summary table

From the model summary table, it is possible to assess how well a regression model fits the data by using the R , R^2 , adjusted R^2 , and standard error of the estimate.

Table 15

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.778a	.605	.593	.35950	1.612

^a. Predictors: (Constant), FC, EE, SI, PE

^b. Dependent Variable: BI

R is the correlation between the variables and measures the strength of the relationship between the dependent and independent variables. The closer the value of R to one, the stronger the relationship (Laerd Statistics, n.d.). In our model, R was 0.778 (see Table 6). The R^2 value, also known as the coefficient of determination, is the percentage of variance in the dependent variable that can be explained by the independent variables and is displayed in the "R Square" column (Laerd Statistics, n.d.). Based on Table 6, the value of R^2 indicates that changes in the independent variables were responsible for 60.5% of changes in the variance of the dependent variable. The adjusted R^2 has a value that lies between 0 and 1, with the predictive power of the model increasing as the value approaches one, and vice versa. Always, the adjusted R^2 is either lower than or equal to R^2 (Laerd Statistics, n.d.). In the model, its value was .593, which is a good value according to statistical convention.

5.1.6 Estimated model coefficients

As mentioned above, the ANOVA table shows the significance of the model as a whole as well as the combined effect of the independent variables on the dependent variable, while the effect of each of the independent variables on the dependent variable can be obtained using the coefficients table (Laerd Statistics, n.d.).

Table 16

Model Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	B/ Std. Error	P-value	95.0% Confidence Interval for B	
Variables	B	Std. Error	Beta	t	Sig	Lower Bound	Upper Bound
(Constant)	1.140	.296	--	3.849	<.001	.554	1.726
EE	.413	.055	.528	7.543	<.001	.305	.522
PE	.264	.066	.284	4.021	<.001	.134	.394
SI	.150	.062	.142	2.433	.066	.028	.271
FC	-.132	.062	-.124	-2.119	.076	-.254	-.009
ANX	-.143	.045	-.146	-3.075	.025	-.062	-.223

^a. Dependent Variable: BI

The table of coefficients above reflects the final results of the regression model, which allows testing hypotheses, building the regression equation, and determining the effect of each of the independent variables on the dependent variable. The table includes the standardized (beta) and unstandardized (b) values of the estimated coefficients. Standardized values indicate that these values for each of the different variables have been converted to the same scale, and are therefore useful for making comparisons between variables to determine the factor that has the most influence on the dependent variable (Tabachnick & Fidell, 2019), while the values of the unstandardized coefficients are used to predict the effect of a change in the dependent variable as

a result of a change in the independent variable by one unit, holding all other factors constant (Pallant, 2016).

5.1.7 Hypothesis testing

The significance of the coefficients must be tested before interpreting the results and writing the final forms of the regression equations for the purpose of prediction and knowing the impact of each variable. Using the results of a two-tailed t-test shown in Table 16, the null hypothesis can be verified by comparing the p-value (Sig) with the preselected value of alpha (.05) for each standardized and unstandardized coefficient. Coefficients with p-values less than alpha are statistically significant, i.e.:

We accept null hypothesis $H_0: \beta_1 = 0$ if $p\text{-value} > 0.05$.

We reject null hypothesis $H_1: \beta_1 \neq 0$ if $p\text{-value} < 0.05$.

Accordingly, Table 16 shows that all coefficients are statistically significant at the 5% alpha level, except for SI and FC. The P value corresponding to the coefficients (constant, EE, PE, and ANX) was < 0.05 , while the p-values for SI and FC are 0.066 and 0.076, respectively, which are greater than 0.05 and not statistically significant, so we accept the null hypothesis for the two variables.

5.1.8 Regression equation for the model

The regression equation can be presented in two ways:

First, unstandardized B values are used for the purpose of prediction:

$$BI = 1.140 + 0.413 EE + 0.264 PE - 0.143 ANX \longrightarrow (1).$$

The estimates, which are the unstandardized coefficients in Equation 1, indicate the amount of change in the dependent variable (behavioral intention) that can be predicted as a result of a one-unit change in any of the independent variables, holding all other factors constant

(Keith, 2015). In other words, if individuals' perception that using EHRs will lead to greater performance benefits is enhanced, or if their belief that they are easier to use is enhanced, their behavioral intention to use the technology is expected to increase, while there is an inverse relationship with the anxiety variable. This means that as feelings of anxiety increase, the predicted behavioral intention to use EHRs decreases, and vice versa. That is, to encourage workers to accept a technology, work must be done to reduce the level of this indicator.

This relationship can also be expressed mathematically as follows:

- When the effort expectancy factor (EE) is positively influenced by one-unit, behavioral intention (BI) increases by 0.413 units.
- Likewise, when the performance expectancy factor (PE) is positively influenced by one unit, this will lead to an increase in behavioral intention (BI) of 0.264 units.
- However, increasing the amount of anxiety (ANX) about utilizing a technology by one-unit results in a 0.143-unit decrease in behavioral intention (BI).

Second, standardized beta values are used for comparison, as shown below.

$$BI = 0.528 EE + 0.284 PE - 0.156 ANX \longrightarrow (2).$$

Based on the standardized coefficients shown in Equation 2, we can compare the influences of the independent variables on the dependent variable (BI). In this case, the independent variable with the highest standardized coefficient (0.528) is EE (effort expectancy). Therefore, EE has the greatest influence on the dependent variable. Meanwhile, PE (performance expectancy) has a lower standardized coefficient of 0.284, indicating a comparatively weaker influence. Anxiety (ANX) has a negative standardized coefficient of -0.156, indicating a negative influence on the dependent variable. So, in terms of standardized coefficients, EE has the most significant influence on the dependent variable (BI) compared to PE and ANX. Using standardized

coefficients allows for a fair comparison between independent variables, as they are measured on the same scale and their relative contributions can be assessed.

The analysis indicates that the non-standardized values did not exhibit any notable deviation from the standardized values. Given that the data for this model were obtained by utilizing a five-point Likert scale, the responses were encoded as ranging from 1 to 5. This coding methodology ensures uniform measurement of all responses on a standardized scale, facilitating coherent comparison and analysis. Consequently, the standardized values attributed to each response category demonstrated minimal variance compared to the outcomes derived from the non-standardized values. As emphasized earlier, standardized values hold greater significance particularly in models employing diverse units of measurement.

5.1.9 Results

In the realm of technology acceptance, numerous studies have successfully identified factors that significantly influence individuals' behavioral intentions to use a technology (Venkatesh et al., 2003). These factors have been recognized as valuable tools for promoting technology acceptance. However, it is important to note that the findings regarding these factors can differ from one study to another due to variations in the phenomenon under investigation and the unique conditions in which the institutions being studied operate (Davis, 1989; Rogers, 2003). For example, the specific technology being examined, the characteristics of the population under study, and the organizational or cultural context are among the factors that contribute to these differences (Orji & Moffatt, 2018; Venkatesh & Bala, 2008). As such, researchers strive to identify and understand the most relevant factors in specific contexts to enhance our understanding of technology acceptance and inform targeted interventions and strategies. Acknowledging contextual differences in outcomes allows for a more comprehensive

understanding of the factors that shape technology acceptance, facilitating the development of tailored approaches to promoting technology adoption in diverse organizational settings (Orji et al., 2019). Consequently, further research endeavors are crucial in advancing our knowledge in this field and guiding the effective implementation of technological changes in organizations.

The analysis revealed that changes in the independent variables accounted for 60.5% of the changes in the dependent variable (behavioral intention). This agrees with what Venkatesh et al. (2003) found, which was that changes in the independent variables explained 70% of the variation in behavioral intention. Also, the findings suggest that effort expectancy (EE), performance expectancy (PE), and anxiety (ANX) play significant roles in influencing the behavioral intention (BI) of professionals towards technology adoption in healthcare institutions. However, social influence (SI) and facilitating conditions (FC) did not seem to have a significant impact on behavioral intention in our study.

5.1.10 Analysis of results

These results are consistent with the findings of Venkatesh et al. (2003) regarding their theory that effort expectancy and performance expectancy have the greatest impact on behavioral intention, which is what a number of other researchers have also found (Khan et al., 2019; Sair & Danish, 2018; Zhou et al., 2020).

In contrast to the finding by Venkatesh et al. (2003) that social influence and facilitating conditions have a slight effect on behavioral intention, they had no effect on the results in the current study. This is consistent with the results of the study by Cimperman et al. (2016), which did not find any effect of social influence on behavioral intention, as well as that by Tavares et al. (2018), which did not find any effect of facilitating conditions.

While research conducted by Venkatesh and Bala in 2008 indicated that anxiety can be an important factor influencing users' intentions to adopt a technology, high levels of anxiety can lead to resistance to adoption, which is consistent with the findings of the current research. This correlates well with some other studies, such as those by Ebnehoseini et al. (2020) and Almarzouqi et al. (2022), who confirmed that the anxiety factor had an impact on behavioral intention.

5.1.11 Conclusion

By referencing the preliminary findings of the research regarding the sample participants' proficiency in computer usage and their awareness of electronic health applications, and linking them with the final results, we can identify several essential interventions that could impact the behavior of these healthcare professionals towards the adoption of Electronic Health Records (EHRs).

Our results showed that practical experience and training among the sample participants in using electronic health records did not exceed 14% and 17%, respectively, which are very low percentages, indicating that awareness was mainly limited to theoretical knowledge only. Since awareness is one of the main determinants affecting the effort expectancy and performance expectancy factors (Venkatesh & Bala, 2008), the results of the research showed that these factors have a significant impact on behavioral intention. Thus, employing awareness and training programs on the use of electronic health records is a necessary intervention that will enhance individuals' knowledge of the perceived benefits, as well as increasing their confidence in their ability to easily use these records, thus helping ensure their acceptance.

It was also mentioned above that anxiety is one of the significant factors influencing the behavioral intention of the study participants towards using technology, which may be due to the

limited use of information technology within health institutions and their complete dependence on paper systems, which have made the use of computers uncommon among workers in these institutions. The study revealed that more than 40% of the sample had not properly mastered the use of basic computer programs. Since increasing levels of anxiety among workers towards technology negatively affect their intention to use it (Venkatesh & Bala, 2008), therefore developing intensive training programs on computer use is one of the interventions that will reduce the level of anxiety among employees in using technology and contribute to the successful acceptance of the use of electronic health records.

The first part of this chapter revealed some behavioral aspects of employees related to technology acceptance, based on the unified theory of acceptance and use of technology. To complete the picture, the second part of this chapter will analyze interviews that address other factors that affect technology acceptance, such as technological infrastructure, legislation regulating the exchange of electronic information, financial capabilities, and other topics that pertain to the research objectives.

5.2 Part Two: Results From Interviews

This section presents the findings from the interviews. Through an analysis of the transcripts and notes taken during the interviews, recurring words, phrases, and patterns were identified, and key concepts that appeared repeatedly were closely evaluated, identified, and linked to the participants' data. These concepts were then developed into themes and sub-themes and categorized accordingly.

The following discussion explores these categories, examining the extent of health information technology (HIT) use in the targeted hospitals, the challenges these institutions face in implementing or adopting this technology, and the participants' perspectives on the role of electronic applications, particularly electronic health records (EHRs), in enhancing health services. Using the data analysis processes described in the methodology chapter, three main categories were extracted, and each was divided into several themes, as detailed below.

Category One: Health Information Technology Environment in Libyan Hospitals. This category provides a clear picture of the extent of HIT use in the targeted hospitals, including their experiences or attempts to use electronic medical records. It is divided into four topics, with each dealing separately with a specific hospital.

Category Two: Barriers to Using Health Information Technology. This category addresses the obstacles these institutions face in using HIT, and particularly in adopting EHRs. These barriers are divided into five themes: technological infrastructure, skills, laws and regulations, work culture, and financial resources.

Category Three: Opportunities and Advantages of Using Electronic Health Records. This category highlights the benefits that can be gained from using E-health applications. It is divided into six themes: health information exchange and clinical decision support, scheduling

appointments and reducing wait times, efficiently managing patient files, enhancing diagnostic efficiency and reducing costs, reducing medical errors, and the advantages of e-referrals.

Table 17

The interview results: Categories, themes, and sub-themes

Categories	Themes	Subthemes
Technological environments of hospitals	1. Al-Khadra Hospital 2. Tripoli University Hospital 3. Tripoli Central Hospital 4. National Heart Center	
Barriers to the use of information technology	1. Technological infrastructure 2. Skills 3. Work culture and officials' interests 4. Financial resources 5. Legal frameworks	1. Network infrastructure 2. Internet services 3. IT hardware
Opportunities to use information technology	1. Facilitate health information exchange and clinical decision support 2. Schedule appointments and reduce waiting time in hospitals 3. Efficiency and speed of access in managing patient files 4. Enhancing diagnostic efficiency and reducing costs 5. Reducing medical errors 6. E-referral advantages	

5.2.1 Category One: Health Information Technology Environment in Libyan Hospitals

According to Rosen et al. (2018), the work environment within hospitals is extremely complex, and requires coordination between different specializations and the use of modern tools to ensure a smooth and harmonious workflow. Information technology has played a pivotal role in global health service development, and health institutions around the world have increased their interest in relying on health information technology (HIT) because of its impact on

supporting and improving health services (Alotaibi & Federico, 2017). This section of the research focuses on understanding the electronic applications employed by the targeted hospitals, the extent of their HIT usage, and their prior experiences. The analysis aims to provide a background that facilitates a greater understanding of the reasons behind the limited reliance on HIT in these hospitals, which can only be ascertained through in-depth study conducted within these institutions.

5.2.1.1 Theme One: Al-Khadra Hospital

Interviews with volunteers and a review of documents reveal that among the hospitals studied, Al-Khadra Hospital has had a unique experience in attempting to adopt HIT. In 2008, the hospital engaged two foreign companies: HealthShare, an administrative consulting firm, to develop a comprehensive administrative operating program, and iSOFT, a firm specializing in health information technology. Participant #10 noted that “iSOFT installed an integrated internal network and provided the hospital with an electronic medical record system. These companies also supervised staff training and hospital operations for a full year.”

The installed system included electronic patient admission records, laboratory records, medical imaging records, pharmacy records, financial management records, human resources records, a data storage unit, and a data protection system. However, numerous primary features remain underutilized, thereby limiting their potential benefits. For example, Participant #11 mentioned:

The patient record only contained identifying information and residence registration data, leaving out medical information. Doctors, on the other hand, could access medical laboratory results and medical imaging from their respective departments. They only used

the pharmacy record for medication dispensing and inventory management; they did not link it to other departments.

Due to the circumstances the country faced in 2011, this project no longer received the attention of new administrations and was neglected. Additionally, the equipment became outdated due to a lack of continued spending on its development, with one participant commenting that:

This constituted the first phase, with a second phase planned that was to include the entry of patients' medical files. However, the country's conditions and the resulting obstacles prevented the implementation of the second phase, resulting in a neglect of the progress made. Other hospitals could have applied the lessons learned from this experience, but the circumstances hindered the project's completion. (Participant #12)

5.2.1.2 Theme Two: Tripoli University Hospital

The Tripoli University Hospital has an electronic medical record system that functions for both patient admission records and a civil status information source for registering births and deaths. However, the hospital has not yet activated the function to enter patients' medical information. Participant #5 stated that “the analysis laboratories and medical imaging centers computerize and store their results in separate units, but they do not electronically transfer these results to the departments due to incomplete network coverage.” The hospital's internal network only partially functions and does not cover all departments, which limits its benefits. Participant #6 noted that:

The network is partially working, and we are trying to benefit from it as much as possible; for example, this week, a live surgery was broadcast with high quality, and a large number of trainees were able to attend it from the room designated for conferences, listening to the specialist's notes and directions.

The trust factor also played an important role in the hospital's experience of adopting electronic medical records, as although there was an attempt to use the electronic record to digitize patients' health information, doctors rejected it because of their lack of confidence in the implementing agency, and the project failed. According to Participant #5:

Initially, there was an attempt to circulate an electronic record to the departments to enter patients' medical information, but the doctors did not agree to this record because they did not trust the executing company, claiming that it might leak patients' health information because the company belonged to a country where a large number of Libyans are receiving treatment.

The country's decade-long instability compelled successive administrations to prioritize the provision of basic operational requirements for institutions over development, and one participant commented that:

In addition to the negative effects of this instability, such as resource waste, infrastructure neglect, and a lack of attention to training programs on modern technology and its use to keep pace with development, the Ministry of Health has not provided any direction or obligation for hospitals to adopt this technology. (Participant #8)

5.2.1.3 Theme Three: Tripoli Central Hospital.

The Tripoli Central Hospital had not yet made any previous to use the electronic medical record function at the hospital level, but its Medical Analysis Laboratory and Medical Imaging Centre have the ability to store data and retrieve results in the form of medical reports or images. Many participants expressed hope for the hospital's development and the availability of electronic records to facilitate their tasks; however, they stressed that the hospital's senior management and the Ministry of Health must take the initiative to develop a plan and provide the

necessary capabilities. In the context of operating ability, Participant #16 stated that “there are a large number of doctors who have experience dealing with different types of electronic applications through their studies, work abroad, or as a result of their cooperation with the private sector; moreover, intensive training courses will solve the skills problem”.

Participants confirmed that there is no trend from the hospital administration towards using information technology. For example, one interviewee commented that:

From my experience, hospital workers of all specialties welcome any training courses that help them perform their work, as the course is considered an advantage given to the employee. Unfortunately, there is currently no plan to develop workers' skills in using health information technology or invest in this field. Instead, all the focus is on maintaining hospital buildings and providing operating supplies and medical equipment.

(Participant #13)

Although there is modern equipment in the hospital, the benefit from them remains limited because there is no internal network. In this context, Participant #15 suggested that “integrating the hospital's modern medical equipment in the laboratories, imaging center, outpatient departments, and clinics into an electronic record through the hospital's internal network would enhance its effectiveness.”

5.2.1.4 Theme Four: National Heart Center - Tajoura

Participants emphasized that, like other institutions, the Specialized Heart Hospital does not currently use any electronic health records (EHRs). The hospital's electronic applications are limited to the medical analysis and imaging centers, and are not linked to other departments due to the absence of an internal network. It should be noted that there was an experiment by the

hospital to adopt an electronic health system, but it was not met with success. As reported by Participant #4:

In 2005, the hospital attempted to implement an EHR system, initially entering medical data for patients. However, the system ceased functioning due to several issues, including technical malfunctions, negligence, and a lack of appreciation for its importance. The failure of this initiative highlights the critical need for proper planning, adequate resources, and continuous support.

Spreading awareness of the importance of health information technology in improving health services, encouraging its use, and ensuring the availability of an appropriate climate are among the factors that ensure its acceptance and continuation. For instance, institutions could implement comprehensive training programs and workshops to familiarize staff with the benefits and functionalities of EHR systems before the adoption process. Perhaps the best example of this is this hospital's experience using electronic medical records at the time, which emphasizes the necessity of continuous education and support to achieve long-term success. Within the same context, one participant made the following observation:

The implementation of electronic medical records in the hospital was premature, meaning that the time was not appropriate. During that period, this term was not widely used, nor was information technology as prevalent as it is today, as exemplified by the proliferation of smartphones and other digital devices. This evolution in technology has significantly altered the landscape, making it more conducive to adopting EHRs today. The private sector's use of electronic applications in the health field has also made public sector health professionals more aware of and willing to accept them. (Participant #1)

However, there is a need for more attention, awareness-raising, and encouragement for staff to fully embrace these changes. For instance, providing incentives for adoption, showing successful case studies, and addressing concerns about the transition can further facilitate the integration of EHR systems.

5.2.2 Category two: The Challenges of Using Information Technology

One of the main research objectives is to study the target institutions and accurately describe the challenges they face in adopting electronic health records (EHRs). This understanding helps in proposing solutions to ensure the successful adoption of this technology in the future. Through analyzing the interviews, several challenges faced by these institutions in using EHRs emerged, and were classified into six basic themes, as follows.

5.2.2.1 Theme One: Technological Infrastructure

To effectively use health information technology in hospitals, such organizations must have the basic infrastructure components to support the exchange, storage, and transmission of health data and ensure its security and accessibility. According to Atlassian (n.d.), these technological infrastructure components provide the foundation for the deployment and use of various health information technology systems and applications, including hardware, software, networking, data centers, and cloud services.

The results of the interviews revealed that the technological infrastructure of these hospitals was extremely weak and lacked essential components. The analysis showed that the participants' opinions focused on three sub-themes that reflect the weaknesses of the necessary components, which are the internal network of hospitals, Internet services, and hardware.

5.2.2.1.1 Wired Network Infrastructure

The internal network is the cornerstone of electronic applications that facilitates daily tasks for healthcare workers, such as booking appointments, making referrals, and accessing medical and pharmaceutical laboratory results. This infrastructure is crucial for the widespread adoption of electronic health records (Herman, 2023). Internal network infrastructure enables health institutions to connect to the Internet and establish interconnections between various offices and data centers. Some participants highlighted the technological infrastructure's shortcomings, particularly the hospitals' absence of an internal network for electronic information exchange. For example, one participant, referring to the central hospital, said:

The hospital lacks an integrated internal network for exchanging health information and facilitating work. An internal network would undoubtedly help connect various departments, easing daily operations. For instance, with a network, the radiology department and the medical analysis laboratory could link to other departments, allowing treating physicians to access results quickly and easily. (Participant #6)

The previous examination of hospitals' IT environments revealed that only Al-Khadra Hospital had an integrated internal network capable of electronic information exchange. The University Hospital's internal network connected only some parts, indicating the need for an upgrade, while the remaining hospitals lacked these networks entirely. Participant #8, drawing on extensive experience in information technology and the health sector, confirmed that:

Internal networks are the backbone of health information technology. The absence of integrated internal networks is the primary barrier to adopting this technology in hospitals. Despite the availability of local companies that can implement these networks

using fiber cables at reasonable costs, hospital administrations show little interest or planning in leveraging information technology over traditional systems.

5.2.2.1.2 Internet Services

Today, Internet service has become one of the basic pillars of any institution, especially health institutions, as a means of communication, research, education, training, and information exchange. According to Ventola (2014), the Internet is the key factor enabling the use of electronic applications such as electronic health records and telemedicine, which break down geographical barriers and allow patients in remote areas to receive timely medical consultations. Moreover, the Internet is indispensable for continuing medical education and training, helping healthcare workers stay updated with the latest knowledge and skills. Without a strong Internet connection, health institutions will struggle to implement and utilize modern IT-based healthcare technologies and practices.

Participants confirmed that the quality of Internet services in Libya has significantly improved in recent years, with several competing companies offering reliable high-speed service that supports electronic information transfers. However, this service is limited within hospitals and is not available to all employees. Participant #5 indicated that “Internet service is available to employees based on work requirements or managerial status.” All the hospitals studied had this phenomenon, where certain employees occasionally receive Internet service as a privilege due to their job status or work needs. For example, “... if an employee needs the Internet to perform their work, they submit a request to the relevant department and obtain the service. As a result, the number of employees who can access this service is limited” (Participant #12).

Despite the importance of this service for practitioners for their fields of work, personal development, and learning, administrations still believe it is not necessary for all staff. This is

even though Internet access should also be available for patients within hospitals. One participant commented on this point, stating:

Many health providers usually rely on their mobile phones to access some information from the Internet because there are no computers equipped with this service that practitioners can easily access. Providing this service would encourage practitioners to use information technology, potentially improving their performance. (Participant #4)

5.2.2.1.3 IT hardware

According to Aanestad et al. (2017), IT hardware refers to all the physical machines and devices that an organization uses in its IT environment. This hardware comprises the storage devices and servers that provide an organization with network resources, and also includes endpoint devices such as computers, phones, and tablets. Participants emphasized that the hospitals included in the study largely lacked these components for adopting health information technology. Participant #11 expressed concern about Al-Khadra Hospital, stating, “Many of these components are outdated and in need of updating, making them unreliable for utilizing electronic health records, given their origins dating back to 2008.” The participant added that the hospital owns a number of modern desktop and tablet computers and their accessories, but they are insufficient to operate electronic records at the hospital level.

This situation applies to the rest of the hospitals, as well. For instance, Participant #8 indicated that:

... the equipment in the university hospital is considered good and meets the needs of current uses (such as patient admission records, administrative and financial affairs, and some departments), but it will not be sufficient if we adopt electronic health records.

Two other hospitals, Tripoli Central and the National Heart Center, also lacked internal networks. Therefore, implementing electronic health records will require providing an internal network for these hospitals, in addition to filling all other requirements to operate the network and utilize these records.

The analysis of the interviews, which revealed that the technological infrastructure in these hospitals is inadequate and does not support the use of health information technology, explains one of the questionnaire results from the first section of this chapter: there was no effect of Facilitating Conditions (FC) on the behavioral intention (BI) of employees towards the use of electronic health records.

5.2.2.2 Theme Two: Skills

The interviewed healthcare providers confirmed that a lack of skills is one of the expected barriers when adopting electronic health records. This finding aligns with the World Health Organization (2022) study on the obstacles faced by health institutions in developing countries when using health information technology.

Participants highlighted the lack of human resources specializing in information technology and the absence of necessary skills among some service providers to handle this technology. All hospitals faced a significant shortage of IT specialists. For instance, according to Participant #11, “Al Khadra Hospital has only two IT specialists who manage all network and device maintenance, along with some data entry personnel in the documentation and information department.” The situation was similar in the other hospitals, where the number of IT specialists did not exceed three or four per institution. One participant commented that “this number of technicians somewhat meets current needs because the reliance on information technology in

their hospital is limited. But this number will not be sufficed if the hospital adopts electronic health records in the future” (Participant #5).

Participants also noted a challenge in using electronic health records that was related to the skills of service providers. There is a shortage of skilled medical data entry personnel, necessitating efforts to develop the skills of data entry staff in departments and archives. For example, digitizing patient files and transferring paper-based data to an electronic format requires a sufficient number of properly trained workers, as even with modern scanners, data entry still demands specific skills. Participant #2 indicated that:

When electronic records were introduced in the Heart Hospital in 2008, new employees with skills in data entry and managing electronic medical records were hired. However, hiring new employees for these roles today is challenging due to the already large staff in hospitals.

The staffing imbalance mentioned in the fourth chapter of this research has caused shortages in some specialties required in the health sector, as confirmed by participants from all hospitals. As pointed out by Participant #3:

The significant increase in employment over the last decade did not yield skilled workers, particularly in nursing, to replace the foreign workers who left the country after 2011. Most new hires were recent graduates lacking the practical experience needed to fill the gap. This deficit is worsened by the weak training programs that have not significantly contributed to their development, an issue that also affects health technicians.

Participants indicated that the solution lies in qualifying workers in the required specializations and providing them with intensive training courses based on a comprehensive training plan. Additionally, there is a need to develop training programs for employees, tailored to their

specific functions, to enhance their competencies in using electronic health applications.

Regarding doctors, one participant noted that:

It is not expected that doctors will face major difficulties using electronic health applications. Most doctors are accustomed to using electronic means, especially since many currently work or have worked in the private sector, where electronic health applications are widely used. (Participant #13)

5.2.2.3 Theme Three: Work Culture and Officials' Interests

According to the Unified Theory of Acceptance and Use of Technology, work culture is considered one of the factors that help workers accept and use technology. Workers in institutions that rely on the use of computers and modern technologies to perform their work are more accepting of using any new electronic applications within the scope of their work because, to some extent, they are accustomed to the use of technology, which has become part of the work culture. This applies to workers in the public and private sectors in most developed countries. On the other hand, workers in institutions that rely on traditional systems to perform their tasks (the paper-based system) experience the phenomenon of resistance to technology, which limits their use of it. This is exemplified by the case of the Libyan hospitals under study.

As previously mentioned, these hospitals limited the use of electronic applications to specific functions, including administrative and financial affairs, personnel affairs, documentation and information, analysis laboratories, and some pharmacies. Certain offices used computers only for prestige. This led to the hospitals relying on a paper-based work system, causing workers to become accustomed to this style of work and perceive change as challenging. In this context, one participant shared his personal experience, stating:

I suggested to one of the department heads in the hospital to use the Excel program to register the department's patients and their data as an internal record for the department to help him manage the department efficiently instead of the paper system, but he found the matter difficult and neglected it despite the presence of some administrators and nurses capable of doing so with this work. (Participant #2)

Many participants also noted that those responsible for senior administrations in hospitals and the Ministry of Health are not interested in changing the traditional work pattern. For example, Participant #6 stated that:

The hospital administration shows no interest in implementing new work practices, such as implementing an internal electronic system for internal correspondence. This would create an internal network that links all hospital departments, facilitating the rapid exchange of information and circulars. This approach would replace the traditional system and administrative bureaucracy. (Participant #6)

Although the Ministry of Health is considered the body responsible for developing the health sector, there has been no published plan or initiative from the Ministry of Health to use e-health solutions as tools to support health services. Most of the healthcare providers interviewed confirmed that there is no direction or action plan from the Ministry of Health mandating hospitals to develop their work systems and move towards electronic transformation. In this regard, Participant #3 indicated that:

The only letter from the Ministry of Health on this subject was several months ago asking hospital pharmacies to use an electronic application to link them to the medical supply to provide medicines, and no letter was attached to follow up, provide support, or otherwise.

5.2.2.4 Theme Four: Financial Resources

The interviewed healthcare providers were asked to share their perspectives on hospitals' financial capacity to adopt electronic health records (EHRs), and they emphasized that hospitals were heavily dependent on budget allocations from the public treasury as their primary financial resource, lacking alternative funding sources or revenue streams. Due to the stringent allocation of expenditures from this budget for predetermined items, the hospitals faced limited flexibility in allocating additional funds. Participants underscored the absence of internal funding sources within hospitals, citing the inactive status of medical insurance and the provision of free healthcare services to all citizens. Consequently, the hospitals relied solely on budget money being transferred from the public treasury as their sole financial lifeline.

Moreover, participants highlighted various financing challenges encountered by hospitals. These challenges included shortages of essential operating materials due to delays in purchasing and supply operations. Insufficient budget allocations exacerbated these issues, forcing hospitals to resort to purchasing on credit, thereby accumulating debt. Participant #12 provided insight into why hospital budgets struggle to keep up with changes in global prices and the depreciation of the Libyan dinar, saying:

Despite the intention to cover salary increases due to employment expansion, the budget increases overlooked the impact of external economic factors, specifically inflation. As a result, the budgets were insufficient to meet many of the hospitals' essential needs, and they were unable to meet their obligations.

Participants stressed the significant challenge hospitals faces in securing sufficient financial resources for EHR adoption, and highlighted the lack of financial capacity to invest in accreditation processes and necessary infrastructure for EHR implementation. To address these

challenges, participants emphasized the importance of Ministry of Health intervention, urging the development of a comprehensive plan and the allocation of a regular budget to ensure the success and sustainability of EHR adoption initiatives.

On the other hand, when participants were asked about their opinions on solutions that could help hospitals improve their financial conditions and enable them to keep pace with technological progress, especially in medical information technology, several insights emerged. Some participants pointed out that hospitals do not make optimal use of their human resources and substantial physical assets, such as buildings. Currently, outpatient clinics in these hospitals operate only from 8 a.m. to 3 p.m., and after this period, the clinics close their doors and only the ambulance unit continues to operate, despite the presence of a large staff. During these hours, the hospitals are very crowded, but afterward the hospitals are empty except for residents and staff. For instance, Participant #7 suggested that “the University Hospital, which has more than 100 doctors, could operate clinics in an additional shift during the evening period, from 3 p.m. to 10 p.m. This would better utilize the available resources.” Another participant also emphasized this issue, saying,

Why not set a reasonable fee for each patient? There is no doubt that this mixed system will help hospitals achieve a return that will help them pay incentives to doctors and provide necessary resources, thus improving their services and reducing the burden on the public treasury. (Participant #10)

In addition, some participants highlighted the need to expedite medical insurance activation so that hospitals could receive additional income to help meet their obligations. However, another group of participants stressed the necessity of rationalizing spending and combating administrative and financial corruption.

5.2.2.5 Theme Five: Legal Framework

According to George et al. (2013), the legal framework is a crucial component in governing the implementation and operation of e-health systems, since a well-established legal and ethical framework provides clarity on regulations and legislation governing such, ensuring the success and continuity of this technology in healthcare organizations. These regulations delineate the consequences of health data breaches, unauthorized access, and violations of patient privacy, empowering healthcare institutions to address and report such incidents to the appropriate authorities.

However, participants noted a lack of systems or legislation regulating electronic health in Libya. Thus far, hospitals have reported no significant issues or privacy violations due to the limited use of electronic applications. While some participants noted that there are other dimensions that must have legal coverage before adopting electronic health records in hospitals, for example, a signature when requesting patient consent, a medical prescription, etc., as they are all paper-based, there must be a legal basis, i.e., legislation, to be recognized when it becomes electronic. Participant #12 noted the experience of Al-Khadra Hospital, in that “the hospital maintains paper patient admission files in addition to electronic files and did not dispense with paper copies, even though they take up large spaces to store because they are the basis and are legally recognized.”

The absence of a comprehensive legal framework for e-health thus poses a significant challenge to the adoption of electronic health records. Libyan Health Law No. 106 of 1973 serves as the basis for regulating the health sector, but it does not address the regulation of exchanging health information electronically. Current Libyan laws primarily focus on communications, social media, and others, such as Law No. 5 of 2022 regarding combating

electronic crimes, which is unrelated to healthcare. Participants suggested that the legal department at the Ministry of Health be involved in developing and obtaining approval for a robust legal framework. Also, leveraging laws and regulations from other countries with established e-health records governance could inform the development process and ensure alignment with international standards.

5.2.3 Category Three: The Benefits of EHR Adoption

In this digital age, e-health applications, especially electronic health records (EHRs), have revolutionized healthcare delivery by improving efficiency and accuracy and facilitating access to health services (Paul et al., 2023). Despite the global trend towards digitization, however, many hospitals in Libya still rely on traditional paper systems. This part therefore explores participants' views on the opportunities that e-health adoption can provide to Libyan hospitals.

Participants agreed that adopting electronic health records in Libyan hospitals would have a positive impact on both patients and service providers, ultimately improving the quality of health services. Participants' opinions centered around six primary benefits of implementing this technology, summarized as follows.

5.2.3.1 Theme One: Facilitating Health Information Exchange and Clinical Decision Support

An electronic health record (EHR) is a digital version of a patient's paper chart. It is a real-time, patient-centered record that immediately and securely makes information available to authorized users. It contains the patient's medical history, diagnoses, medications, treatment plans, immunization dates, allergies, x-rays, laboratory results, and tests (Menachemi & Collum, 2011). Participants highlighted the importance of using electronic health records that enable healthcare providers to access patient files and medical history immediately, which is especially

important in emergency situations where time is of the essence. Participants also stressed that immediate access to comprehensive patient data helps doctors significantly speed up diagnosis and treatment, reduces the risk of medical errors, and improves the efficiency of services. One participant indicated that:

We often face critical situations in which the time factor is crucial, as the speed of the treating physician's access to the patient's file is crucial to knowing the health problems that the patient suffers from in order to help him diagnose his condition and determine the necessary steps to save his life. (Participant #8)

The participants emphasized the importance of digitizing patient information and the ease with which electronic records, as opposed to paper folders, allow for digital searches. They noted, too, that this digitization can aid in the study of patient information, facilitate comparisons between images and medical analyses, and support clinical decision-making. For example, Participant #11 expressed that:

Through my study of e-health solutions and my practical experience in Libyan hospitals, I can leverage the decision-support tools offered by electronic health records. These tools provide evidence-based recommendations for diagnosis and treatment, assisting caregivers in making informed decisions about diagnosis and treatment protocols, thereby improving healthcare quality.

Many participants also highlighted how these records facilitate the efficient and direct electronic exchange of information between various health institutions, enabling doctors to obtain consultations. This method, in contrast to the traditional approach of referring patients with a physical copy of their files, saves time, money, and effort and supports clinical decisions, thus enhancing the quality of health services.

5.2.3.2 Theme Two: Schedule Appointments and Reduce Waiting Time in Hospitals

Participants indicated the lack of some basic electronic means that would make a difference in health services at the organizational level for receiving patients and organizing their appointments. Using some ICT applications to organize appointments, reminders, and automatic notifications in hospitals helps health care providers provide better service, and more importantly, reduce the number of consultation visits and waiting times (Boone et al., 2022). Participants confirmed that hospitals require an electronic application for scheduling appointments, reminders, and automatic alerts for upcoming appointments. This includes electronic reminders about the day and time of the next visit, as well as notifications about medication taken using e-mail, SMS, or phone calls to ensure patient receipt. In this context, Participant #3 made the following observation:

There is no doubt that using such applications will greatly help us in managing time and arranging appointments, and they do not require special skills to deal with, as we see them widely used in many other service activities today. Unfortunately, hospital administrations have shown no interest in these tools.

Another participant also commented on this topic, saying:

We hope that hospitals will adopt electronic health records, but at the present time it would be beneficial if hospital administrations adopted some electronic applications that help us in our daily work, such as applications for scheduling appointments, medical tests, and internal correspondence. Such applications will pave the way for future reliance on e-health solutions. (Participant #16)

While utilizing these applications does not necessitate exceptional capacities, certain hospitals do not possess the fundamental prerequisites needed for their use. For example, the Heart Hospital

underwent maintenance work across multiple departments and provided numerous devices; however, the administration did not prioritize the renewal or maintenance of the communications network due to its complete breakdown, which forces service providers to rely on radios and mobile phones for communication.

The availability of telephone network and Internet service, along with a scheduling application, can enhance the quality of our services by facilitating direct communication with patients to schedule appointments, reminders, and other services, especially in light of the ability of our staff to handle these tasks. (Participant #14)

5.2.3.3 Theme Three: Efficiency and Speed of Access in Managing Patient Files

The participants also observed that the adoption of electronic health records will alleviate the challenges associated with paper archiving, including the space required for storing, organizing, and maintaining files, the time required for employees to retrieve and return files, and the potential risk of damage due to uncontrollable factors like humidity and fires. In this regard, Participant #12 commented that:

One of the challenges we face is providing spaces to store patient files. We are unable to store them in remote locations due to the increased time required for patient file retrieval and the risk of loss or damage. Additionally, human error, which sometimes occurs when a file is returned to the incorrect location, can make future access difficult and time-consuming, a problem that electronic systems can eliminate.

Some participants also believed that the electronic system is more secure than the traditional paper system. For example, one participant mentioned, "in the traditional paper system, once a person has access to the archives and records, he can access all the files, while access to the electronic record requires permits, access powers, a patient

number, and other security precautions" (Participant #16). In this context, Participant #4 also noted that "the strongest evidence of the importance of electronic records in data preservation is what we saw during the armed confrontation periods that led to damage to some health institutions and their contents, including archives."

5.2.3.4 Theme Four: Enhancing Diagnostic Efficiency and Reducing Costs

Electronic health records allow faster access to various test results and medical imaging. Participants emphasized that linking analysis and medical imaging laboratories to electronic health records enables rapid retrieval of diagnostic information. This, in turn, accelerates the treatment process, enables timely interventions, and reduces the need for repeat tests, which can be costly and time-consuming, thereby improving the efficiency of health services. In this context, Participant #2 said:

Today, there was a patient with breast cancer who had a follow-up scan. Upon the doctor's request for the old photos (mammogram), it emerged that the patient had taken them at a different facility and failed to bring them with her, resulting in the patient receiving a new appointment. This is one of dozens of cases that we see monthly. Such information is necessary to know the progression of the disease, the extent of the drug's effectiveness, and other factors that help the treating physician determine the next stages of treatment. This is a live example of the challenges we face in the absence of electronic health records.

The participants also stressed that relying on electronic medical imaging systems, such as digital radiography instead of X-rays, etc., will enable us to save on the costs of medical imaging films of all kinds. One participant indicated that:

Hospitals possess modern medical equipment, and their effectiveness would be greater with the presence of electronic health records (EHRs). EHRs can enhance the functionality of this advanced equipment by enabling seamless data integration and real-time access to patient information. Diagnostic devices, for instance, can automatically upload results to the patient's electronic record, facilitating faster access for the doctor to review and decide on the patient's next steps, ultimately leading to improved health service. (Participant #13)

5.2.3.5 Theme Five: Reducing Medical Errors

Participants emphasized the importance of electronic systems in strengthening the healthcare system. This is because handwritten documents, like prescriptions and other medical records, are susceptible to errors due to difficulty in reading them. These errors can sometimes lead to incorrect diagnosis readings, medication dispensing, or dose administration. While adopting electronic systems will reduce these risks by providing clear electronic prescriptions and documents, which enhance patient safety and improve the quality of health care in general, participants also highlighted numerous instances where medical liability arises from handwritten prescriptions and the ensuing confusion during reading. In this regard, one of the participants commented that:

The Arabic language in Libya is the official language, while the English language is the accepted language in the medical community, as patient diagnoses, medical reports, prescriptions, test results, etc. are all in the English language. As a result, some people struggle to read prescriptions or reports written by certain doctors because of their varying language skills and the similarity of numerous medical terms, which can lead to mistakes. However, we can prevent these errors by employing electronic systems.

(Participant #14)

Participants emphasized that electronic health records help reduce medical errors by alerting doctors to medications or laboratory values that are in a conflicting or dangerous range. They added that this feature could also guide the doctor to potential interactions that they were not aware of and would not have discovered using the paper-based system currently in use.

As Participant #16 commented, there is no doubt that:

The presence of this application in the hospital will help doctors overcome several difficulties and avoid some medication errors, such as alerting the doctor to possible drug interactions or contraindications for use and providing admission screening tools that identify patients at risk of rejection after organ transplantation, which will enhance the capabilities of doctors and improve the quality of health care for patients.

5.2.3.6 Theme Six: E-referral Advantages

As mentioned earlier in the theoretical framework of this research, electronic referral is defined as “transferring (including sharing) the responsibility of patient care from the referring provider to another physician or provider, so that it also includes the transfer back of patient care at an appropriate time” (Naserias et al., 2015, p. 2). In this context, the participants stressed the importance of electronic referrals in coordinating between health institutions, directing patients and helping them reach specialized health care facilities. They stressed that this smooth and rapid transfer of the patient and their health information leads to better health outcomes. For example, Participant #9 expressed that:

The activation of the referral system is beneficial. Currently, we are grappling with the issue of open access, where many patients receive direct care without going through primary health care centers, a practice that violates applicable regulations. However, the

adoption of electronic referral will eradicate this issue, thereby reducing the patient count and waiting time.

Many of the participants also reported multiple positive effects of electronic referrals on communication and coordination. For instance, one participant mentioned that “certain specialized hospitals frequently struggle to accept referred cases due to a lack of beds or other reasons. However, implementing electronic referrals can enhance coordination between hospitals during the patient reception and acceptance process” (Participant #8).

5.2.4 Chapter Summary

This chapter analyzed the results of both the questionnaire and semi-structured interviews conducted with healthcare providers in the targeted Libyan hospitals. Part 1 reviewed the questionnaire results, and Part 2 reviewed the interview results.

The first part presented the results of the questionnaire analysis, which identified the most important factors affecting the behavior of health service providers in hospitals regarding the use of health information technology, and the results indicated that the most important factors influencing employees’ attitudes toward using information technology are effort expectancy, performance expectancy, and anxiety. Based on the foundations of the Unified Theory of Acceptance and Use of Technology (UTAUT), these factors can be used as tools to influence employees’ behavior toward using information technology. Workers will be more accepting of the technology if they expect it to be easy to use and improve their work performance, and spreading awareness and providing training programs on the use of health information technology can positively influence these factors.

However, the anxiety factor also had a significant impact on employee behavior, and this indicator suggests the presence of a phenomenon known as technology resistance. The results

showed that 40% of participants needed to learn computer skills, and targeted training and encouragement to use information technology can contribute to addressing this issue. The results also showed that social influence and facilitating conditions had no effect on employees' attitudes towards using this information technology. Social influence reflects the impact of peers and the orientation of managers towards using this technology. The interview results showed that managers and departments in general did not have an orientation towards using health information technology, and the medical community does not discuss the importance of these tools. This justifies the lack of social influence on employees' behavior that appeared in the questionnaire results. Facilitating conditions, which include factors that help in using health information technology, such as access to computers, Internet services, etc. (quality of technological infrastructure), also did not affect employees' behavior. The analysis of the interviews revealed that all the hospitals lacked this infrastructure, which justifies this finding. Employees are likely to have a greater tendency to use information technology if it is available in their workplace (Venkatesh, 2003).

Meanwhile, the second part of this chapter reviewed the results revealed by the analysis of the interviews, which centered around three main topics, as follows. First, the use of health information technology in the hospitals studied was very limited, which confirms the findings of the literature review. The interviews also revealed some of these hospitals' experiences with adopting electronic medical records, identifying the reasons for its failure as including neglect, an inability to recognize its significance, and a consequent lack of investment in its advancement and sustainability.

Second, the barriers facing the adoption of electronic health records in Libyan hospitals revolve around the following points:

(1) Weak technological infrastructure, lacking basic components for electronic information exchange; (2) A severe skills shortage, with hospitals lacking information technology specialists, and a large number of service providers needing to enhance their computer skills; (3) Work culture and officials' interests. Health sector workers' reliance on a paper-based system hinders the process of change, a phenomenon known as technology resistance, as we explored in the first section of this chapter. The results also indicated a lack of interest or guidance from various departments regarding the use of information technology in the health system. (4) Financial constraints make the financing process a significant obstacle for hospitals when it comes to investing in electronic transformation programs and covering the costs associated with preparing technological infrastructure, training, and other requirements; and (5) Legal framework. The lack of policies and laws that regulate the exchange of electronic health information and guarantee the rights of all parties is one of the main obstacles to the use of information technology in the health sector.

Thirdly, the participants' perspectives on the potential benefits of implementing electronic health records centered around six key points: (1) Facilitating the exchange of health information and supporting clinical decisions; (2) Scheduling appointments and reducing waiting times in hospitals; (3) Efficiency in managing patient files and quick access to them; (4) Enhancing diagnostic efficiency and reducing costs; (5) Reducing medical errors; and (6) Advantages of electronic referral. Most of the participants interviewed believed that these features and the opportunities provided by this technology would help them perform their work, solve many of the daily problems they face in performing their tasks, and ultimately lead to improving the quality of health services.

Chapter Six: Discussion

6.1 Introduction

This research was inspired by observation of a significant issue affecting Libyan society, which is poor health services. The root of this problem is deep and multidimensional, with a history going back many decades, but its degree has increased significantly since 2011, as was described in Chapters One and Four.

To address this problem, the researcher proposed the implementation of electronic health solutions in the public health sector, with a particular focus on electronic health records (EHRs). The literature review revealed that this technology is not yet in use in Libyan health institutions. In fairness, however, adopting such records presents a significant challenge for many countries due to a lack of comprehensive plans or mechanisms to address potential obstacles and provide suitable solutions. This issue was elaborated upon in Chapter Two.

To develop a framework that includes general strategies to facilitate the adoption of electronic health records in Libyan health institutions, the researcher set several goals, the achievement of which will provide the information necessary to build such a framework. These objectives included:

- Studying the main indicators of the Libyan health sector to understand its mechanisms of operation and its material and human resources, and to highlight the most important problems it faces.
- Exploring the challenges affecting the adoption of electronic health records in Libyan health institutions, focusing on human factors, technological infrastructure, and other institutional elements.

- Investigating the opportunities presented by adopting e-health applications and how these applications can enhance the quality of health services in hospitals.

The researcher formulated three research questions to achieve these objectives, and employed both qualitative and quantitative data collection and analysis methods while utilizing the principles of the Unified Theory of Acceptance and Use of Technology (UTAUT) to study the attitudes and behaviors of employees regarding the use of electronic health records.

This chapter discusses what has been achieved to answer the research questions, leading to the main goal of this research, which is identifying strategies that will help address the challenges facing the adoption of health information technology in Libya, as well as in determining the necessary procedures for the successful adoption of this technology in health institutions.

6.2 Research Question 1: What Are the Challenges to the Adoption of EHRs in Libya?

The adoption of electronic health records (EHRs) in Libyan hospitals faces many challenges related to structural, technological, human, and institutional factors. The detailed analysis of these barriers provided in the research is crucial to understanding these barriers and developing effective strategies to overcome them. The following analysis highlights these challenges in a more specific way, in preparation for building appropriate strategies to confront them:

6.2.1 Weak Technological Infrastructure

One of the most important obstacles to adopting electronic health records in the Libyan hospitals studied is the insufficient technological infrastructure, as represented in the lack of attention to information technology systems. The hospitals studied lacked key components of the IT systems needed to support the implementation of electronic health records, including

deficiencies in networking, hardware, and software. For example, reliable high-speed Internet is essential not only for the enablement of electronic health records, but also for the successful adoption of any electronic application. However, these hospitals have limited Internet connectivity, making it hard for most workers to log in and make use of this technology.

6.2.2 Cybersecurity Risks

The hospitals' incomplete security features increase the risks of possible cyber-attacks. Although the participants did not fear that the studied hospital systems would be exposed to hacks, this was mainly because of the limited use of electronic applications in these hospitals. However, the examples of security breaches of hospital systems in some of the developed countries reviewed in the research reflect that the provision of good security systems and constantly challenging them is one of the main data protection requirements when adopting electronic health records in the future.

6.2.3 Human Resource Challenges

The human element is one of the key components on which the success of EHR adoption depends. The research results revealed many issues related to human resources, which revolve around the topics listed below.

6.2.3.1 Skills Shortage

The research findings indicate that there is a significant shortage of IT professionals and trained healthcare workers who can manage and operate electronic health record systems. The number of IT specialists in each of the hospitals studied is very limited, and in addition, most of the participants had never used any e-health applications, and about 40% of them needed training simply for using a computer. This explains the high index of anxiety among employees regarding the use of electronic health records.

6.2.3.2 Inefficiency of Training Programs

The research findings also prove that the current programs are insufficient for addressing workers' needs, and that there are major failures in training and finance. For example, e-health transitioning demands comprehensive and continuing training on technical aspects as well as relating to the benefits to be accrued from embracing digital technologies in the healthcare system, and such training is woefully lacking at the time of this study.

6.2.3.3 Workforce Imbalance

The research findings showed an oversupply of nurses and administrators, as well as a shortage of doctors and midwives. This imbalance of labor, in addition to the lack of effective training programs, has increased the obligations of health institutions and led to limited use of their services. These institutions also face shortages in other specialties, which hinders the effective provision of health services. These results reflect a structural imbalance in employment at the sector level, which has led to a mismatch between labor market outputs and the workforce that the sector needs.

6.2.4 Weak Governance and Financial Constraints

One significant barrier to the use of electronic health records in the Libyan context is financial constraints, which is common in most developing countries due to the high cost of establishing electronic health record systems, including equipment and software purchases, staff training, etc. (World Health Organization, 2020). The research results revealed that the hospitals included in the study need a lot of work and spending to build the reliable technological infrastructure necessary for the use of electronic health records, including ongoing funding for updates, security, and technical support. The health sector in Libya depends on the government as its sole source of funding, which is often insufficient to meet the needs of hospitals. Moreover,

the research results indicated that the Libyan health sector suffers from weak governance in managing the financial resources that are available. Weak oversight and insufficient accountability have led to the waste and ineffective use of resources, as well as frequent cases of corruption, which was confirmed by Schalk and Al-Tajouri (2021) and has been stated in the annual reports of Libya's Administrative Oversight Authority and Audit Bureau.

6.2.5 Regulatory and Institutional Obstacles

The Libyan Ministry of Health's failure to use information technology to connect different health institutions, including the limited use of e-health applications, increases the complexity of sector management, primarily because of the absence of a clear, strategic plan and vision for adopting e-health systems at the national and institutional levels. In addition, the organizational structure of the Ministry of Health lacks a department or body to handle the accreditation of e-health systems in health institutions. All these aspects reflect a non-interest by the Ministry in this technology as a tool to be used in the development and improvement of health services.

6.2.6 Work Culture and Resistance to Change

The research results indicated that workers in Libyan health institutions are used to heavy reliance on paper-based systems, and there are no initiatives or encouragement from the hospital administrations to use any electronic applications that would help health workers perform their daily tasks. In addition to the lack of familiarity with new technologies and their importance among a large percentage of officials and workers, or what is expressed as "awareness," this has caused the emergence of the phenomenon of technology resistance in these institutions. The results of the research indicated that there was no effect of the social influence factor on employees' behavior or attitudes regarding the use of health information technology. As

confirmed by the interview results, there is no encouragement from officials towards the use of this technology, and these tools have little or no resonance in Libyan medical circles.

Compounding this, the events of 2011 and the resulting instability have affected health workers' behavior ever since, including administrative laxity. Administrations since the 2011 revolution have vowed to fulfill the needs of hospitals and sustain their functioning, but they have consistently overlooked investment in the developmental processes needed to keep pace with progress.

6.2.7 Legal and Policy Challenges

Another of the challenges is a lack of supportive policies and regulations, since the results indicated that there are no comprehensive legal frameworks that regulate the use of electronic health systems, and electronic health records in particular. This includes regulations on health data privacy, security, interoperability, protecting the rights of all parties, and taking into account the ethical and cultural aspects of society to ensure such systems' acceptance. There are also no policies or plans that include financial and technical incentives and encouragement for health care providers to adopt electronic health systems. The reviewed literature indicates that legal frameworks and policies are among the most important factors for the successful use and acceptance of electronic health systems.

The research emphasized the multifaceted nature of the challenges Libyan hospitals face in adopting electronic health records. Addressing these obstacles requires strategies to help confront them, including the development of technological infrastructure, human resources development, financial investment, organizational restructuring, cultural transformation, and supportive policy frameworks. By systematically addressing these challenges, Libyan healthcare institutions can pave the way for the successful integration of electronic health records to

develop the health sector and thus enhance the quality and efficiency of healthcare services across the country.

6.3 Research Question 2: How do EHRs Improve the Quality of Healthcare Services in Libya?

The researcher identified many opportunities that e-health apps, especially electronic health records, can provide to develop the Libyan health sector, and thus improve services. These opportunities were extracted from the findings of the research. A detailed review of the most important of these opportunities is provided in the following.

6.3.1 Improving Efficiency in Providing Health Care

According to Buntin et al. (2011), electronic health records (EHRs) simplify administrative and clinical processes, leading to more efficient healthcare delivery. They eliminate the need for manual record-keeping, particularly when workers are proficient in using these systems. Enabling healthcare professionals to save time and focus more on their patients will increase their productivity, since electronic health records (EHRs) provide healthcare professionals with quick access to comprehensive patient records across various health organizations, including medical history, medications, allergies, and test results (Menachemi & Collum, 2011). Traditional paper systems are time-consuming regarding records access and are exclusive to individual institutions, but electronic health records allow for the rapid uploading and retrieval of laboratory and imaging results, thus reducing wait times (Heart et al., 2017).

Thus, with rapid access to comprehensive patient records via electronic health records, doctors and nurses will be able to come up with faster diagnoses and corresponding treatment plans, thereby enhancing health service efficiency. Electronic health records also address many of the challenges that patients and health care providers typically face during follow-up periods.

For example, participants expressed concerns about patients' failure to bring old medical tests or imaging results for consultations during follow-ups, leading to treatment delays, but EHRs can address such issues by ensuring the constant availability of all necessary information for patient follow-ups, thereby simplifying and enhancing overall patient care.

6.3.2 Improving Coordination of Care

Electronic health records promote improved coordination between various health professionals and organizations. They have an electronic referral feature for the smooth transfer of patient information to specialists or health facilities (Naserias et al., 2015). This allows for the continuity and acceleration of care, and improves integration among various health institutions. The referral process and poor coordination between health institutions were cited as challenges that the service providers encounter every day, but EHRs have the ability to reduce these problems because they enhance the communication and sharing of information, hence providing more integrated and timely care to patients.

6.3.3 Enhancing Patient Safety and Reduction of Medical Errors

Electronic health records greatly improve patient safety by minimizing exposure to errors associated with paper records, e.g., errors in writing or reading manual medical reports, and possible damage to or loss of such records (Khalifeh & Gerami, 2010). They can also help avoid medication errors by providing complete information on medications and alerting healthcare professionals to probable drug interactions or patient sensitivities to some medicines. Moreover, errors from prescriptions that are written manually are reduced. For example, from 1990 to 2019, around 3,224 cases were submitted by the patients to prove medical liability (LMoH, 2019), but the use of EHRs would reduce such incidents by providing better accuracy and reliability for recording and transmitting patient data.

6.3.4 Quality Improvement

Using the EHR data, health care organizations would be able to track performance measures, identify opportunities for improvement, and adopt evidence-based best practices (Buntin et al., 2011). These advantages will enable departments to develop improvement plans targeted at specific areas, and to relate rewards to performance rates. This would encourage employees, and hence their financial conditions would improve, as better performance rates result in enhanced motivation among healthcare staff. All these advantages of the electronic health system contribute immensely to the overall improvement in the quality of health services, and hence represent a potential boost for Libyan health institutions.

6.3.5 Financial and Administrative Efficiency

Electronic health records can lead to cost savings and administrative efficiency, as the system is equipped with a mechanism for organizing the sequence of powers and competencies, which helps administrative work and governance. It also helps avoid unnecessary tests and procedures by ensuring that health care providers have access to the latest patient information, and relying on electronic copies saves on the costs of physical imaging materials such as X-ray film, etc. (Auditor General of Canada, 2009). Furthermore, electronic health records simplify the billing process by automatically capturing charges, facilitating electronic claims submissions, reducing errors, and improving revenue cycle management. All these features will support hospital administrations and improve their performance. The database of these records also facilitates the work of medical insurance companies.

6.3.6 Supporting Health Sector Management

Relying on electronic systems helps the Ministry of Health improve effective communication between health care providers. In addition, adopting e-health applications can

also contribute to improved management and monitoring in the health sector. For example, using pharmacy and warehouse management apps can simplify the tracking of stocks of medicines and medical equipment across hospitals, ensuring timely replenishment before stock runs out. These applications can determine reorder points for strategic stock, in addition to other functions that can help raise the efficiency of sector management. The necessity of systems for managing and distributing medications, medical equipment, and operational materials became apparent during the events of 2011 and the following years, during which hospitals experienced severe shortages of medicines and materials, as mentioned in Chapter Five. Moreover, experiences at the global and Libyan levels during the COVID-19 pandemic have emphasized the necessity of adopting e-health applications, as these applications played an effective role in providing correct statistics about the extent of the spread of the virus, in addition to helping in the organized distribution of vaccines, thus proving their worth in improving health care.

6.3.7 Standardized Clinical Protocols

The use of electronic health records will enhance the Ministry of Health's ability to disseminate clinical guidelines and standardized protocols to various health institutions simultaneously, easily, and quickly. Electronic health records facilitate monitoring and coordination, reducing differences in care between health institutions and improving the quality of services (Menachemi & Collum, 2011). There will be assurance that all health professionals will have access to up-to-date clinical protocols and guidelines under an electronic health record system, unlike the traditional paper system which is characterized by delays and inefficiency. This standardization in practice will bring more uniformity in care and eventually improve both the quality and general efficiency of Libyan health care services.

6.3.8 Improving Population Health Management and Reporting

Aggregated data captured from electronic health records can establish trends of health and monitor outbreaks of diseases in order for the timely formulation of interventions (Ehrenstein et al., 2017). This can enhance the database at the Documentation and Information Center of the Ministry of Health, as mentioned in Chapter Five, consequently increasing speed and accuracy when generating necessary reports.

The findings clearly indicate that e-health solutions have the potential to improve the quality of health services in Libya by solving most of the existing problems in its health systems and institutions. The results also show that implementing e-health applications would result in improved efficiency, accuracy, ease of access, and coordination in the various aspects of healthcare delivery. Libya needs an efficient and effective healthcare system, and thus it is very important that this technology be embraced. The next part will outline a vision for the most appropriate methods to help in overcoming the barriers. Such a vision can help decision-makers to develop a holistic approach towards incorporating electronic health systems within Libyan hospitals, leading to better health outcomes and more efficient health care delivery.

6.4 Research Question 3: What Strategies are Available to Leverage the Adoption of EHRs in Libya?

The strategies identified by the research that will help in the successful adoption of e-health solutions in Libya are discussed in this section. For simplicity, these have been divided into two parts: general or structural strategies, and strategies specific to the hospitals under study.

6.4.1 Section One: Foundational Strategies for National HIT Implementation in Libya

These are major strategies or requirements upon which the foundation of health information technology depends at the national level.

6.4.1.1 E-health Administration

A department or body must be established within the Ministry of Health that deals particularly with e-health, similar to the more advanced countries of the world. This body would be in charge of managing all aspects regarding the implementation of electronic health systems, including plans and programs, and would provide technical and material support for its success and continuity. To facilitate its work, this administration should also open affiliated offices in the six administrative regions indicated in the organizational structure of the Ministry of Health.

6.4.1.2 Legal Framework

There also needs to be a legal framework, supported by laws and legislation setting out the work of e-health. The competent entity can draw from regulations and laws that are in force in neighboring countries, among other nations that already have experience, to establish a legal framework suitable for Libyan society.

6.4.1.3 Electronic Transformation

In the short term, to strive towards electronic transformation and develop the health sector, it is beneficial for the Ministry of Health to rely on the use of information technology. This can be achieved through the implementation of various electronic applications that aid in management and governance. Additionally, the Ministry should work to encourage various institutions within the sector to adopt health information technology, setting urgent requirements and following them up through the relevant department in preparation for developing a comprehensive plan for electronic health records.

6.4.1.4 Planning

After establishing the E-Health Department within the Ministry of Health and providing the legal framework to regulate it, it is necessary for the Ministry to develop a comprehensive

and clearly defined strategic plan at the national level for the adoption of electronic health records. The research results, through a literature review of the experiences of some countries, revealed that having a good plan is one of the most important factors for the success of implementing electronic health records at the national level. The failure of many countries to successfully adopt these records often stems from a lack of a unified strategy that addresses the various issues related to this project and includes all stakeholders. This will involve some critical components, as follows.

6.4.1.4.1 Infrastructure assessment

The presence of a strong technological infrastructure is one of the most important components for the success of adopting e-health. This requires a comprehensive assessment of the current infrastructure of health institutions. In this respect, a review of existing technological capabilities, together with the gaps therein is performed; that is, resources are assessed to upgrade systems so as to make them compatible with the new EHR system. The satisfaction of such needs will smooth health information exchanges and help in successful electronic health record adoption.

6.4.1.4.2 Stakeholders

It is necessary to engage and interact with all relevant stakeholders, including but not limited to medical laboratories, pharmacies, medical imaging centers, and healthcare practitioners, from the beginning. This comprehensive creation process will include potential stakeholders to ensure that their needs and interests are addressed, which is critical for widespread adoption and use of EHRs.

6.4.1.4.3 Encouragement policies

Adopting policies that encourage the adoption of electronic health records, emulating the successful international experiences referred to in this research, such as the American, Canadian, and Australian initiatives, will be also crucial. This may involve providing free applications, comprehensive training programs, and guaranteed technical and monetary support when it is deemed necessary. These will involve all stakeholders and address their specific needs.

6.4.1.4.4 Training, education, and spreading awareness

According to the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003), the human element is the key to the success of technology adoption. Therefore, attention must be given to the human element by designing training and continuing education programs to provide health workers with the necessary skills to operate the electronic health records system. This training will address technical issues, best practices in data recording and management, and integrating the use of electronic health records into daily workflows. There should be a robust mechanism to help the Ministry of Health's training center achieve this goal in addition to its other routine tasks. Given the center's limited training locations, equipping training halls within hospitals may be practical to ensure continuity of training, in addition to organizing scientific conferences and seminars and spreading awareness.

6.4.1.4.5 Financial planning

To obtain funding, both for the initial launch and long-term sustainment, to support the deployment of the EHR system, a proper business case should be made for EHR adoption, documenting the sources of revenue, budget allocations, and ways to ensure financial control for accountability and transparency. Exploring public-private partnerships with insurance companies could also be beneficial. Addressing funding and its sustainability are among the main factors on

which the success of adopting electronic health records depends, especially in developing countries (WHO, 2010).

6.4.1.4.6 Policy development

There should be put in place, in addition to the right legislations, assertive policies regarding issues of data security, privacy, and interoperability. These policies should align with international standards and best practices to ensure the protection of patient information and the seamless exchange of data across different platforms.

6.4.1.4.7 Criteria for selecting an electronic health records system

The Ministry of Health should provide all health institutions and other concerned parties, such as laboratories, imaging facilities, and pharmacies, with unified copies of electronic health records from one of the leading companies in this field, as well as setting unified standards for all relevant parties. This is important in order to ensure a unified programming language that will avoid problems caused by version differences (Torre-Díez et al., 2013).

The Ministry's performance in this role will ensure the unification of the system, thus facilitating the exchange of information between various health entities to improve the efficiency and coordination of health services and avoid costs resulting from differences in applications, which many countries such as Germany, the United Kingdom, and Australia have suffered from. For example, in Australia, the digital health landscape is fragmented, with different electronic health record systems using different standards and programming languages, leading to difficulties in data exchange and increased costs for integrating these systems. The Australian Digital Health Agency has recognized these issues and is developing a national interoperability plan to address them, with the aim of creating a more interconnected healthcare system (Australian Digital Health Agency., n.d.).

The selection process for an EHR provider must be based on strict criteria in order to choose a robust, easy-to-use system capable of keeping pace with the changing requirements of the healthcare sector in Libya. Training is also an important aspect of successful implementation, especially for electronic health records. It should therefore be mandatory to require the implementing agency to conduct training for a specified number of staff in each hospital regarding the use and maintenance of the system. This is similar to the experience of Al Khadra Hospital, which was covered in this study.

Furthermore, the Ministry should establish an institutional mechanism for continuous support and feedback from users so that they can report problems they encounter and provide suggestions for improvement. Involving healthcare professionals in the feedback process will fine-tune this EHR system toward better serving its users, thus enhancing user satisfaction and system effectiveness.

6.4.2 Section Two: Strategies for Promoting HIT Adoption in Hospitals

The study's findings led to the development of several short-term strategies that hospitals participating in the study should adopt in order to help them use health information technology (HIT) effectively to improve their services, as described in the following.

6.4.2.1 Technological Infrastructure

Building and developing hospitals' technological infrastructure is one of the main components of the use of information technology. It is necessary to pay attention to the infrastructure, maintain it, and provide the capabilities that ensure the operation of some necessary applications that will help workers perform their daily tasks. For example, hospitals can maintain or install integrated internal networks that allow the exchange of information between the various parts of these hospitals, and to set a timetable for completing this work.

Participant No. 2, an information technology expert, said, “Hospitals can create integrated internal networks, as the prices for installing these networks have decreased significantly over the past ten years, and financing will not constitute an obstacle to this goal.” These networks will help hospitals use any electronic application.

6.4.2.2 Information Technology Department

It is crucial to focus on the information technology departments in these hospitals, meeting their needs for maintaining and developing any available devices, as well as providing the necessary programmers and equipment for data protection and storage. Hospitals should cooperate by exchanging expertise in the field of information technology to address the shortage of personnel in this field.

6.4.2.3 Work Environment

The study found that some of the causes of resistance to technology in hospitals are due to the lack of a proper climate for its use. This would therefore imply that hospital administrations should ensure work environments that allow training and encourage the use of information technology. Some of the policies that allow acceptance of technology use are:

- Making high-speed Internet service available to all workers within hospitals.
- Equipping some computers with this service at various points within the hospitals or in the hospitals’ libraries.
- Electronic portal for hospitals offering administrative and financial services in order to make the workers comfortable using the computers and to engage them in the culture of electronic services.

6.4.2.4 Application Selection

Selection of a set of applications that would assist hospitals in daily work should be done in relation to laboratory applications, medical imaging applications, and pharmacy applications, and the linking thereof with relevant departments. There also have to be applications for appointment management, scheduling, and patient logins in order to allow a technological environment within the settings of hospitals.

6.4.2.5 Technology Resistance

The research results show that factors influencing employees' attitudes towards the use of health information technology include effort expectancy, performance, and anxiety. According to the UTAUT, these factors can be tools for influencing employee behavior. Education on using computers and health information technology, as well as spreading awareness, can positively impact these factors and reduce anxiety through the following methods:

- **Training:** Continuous training on the use of the computers and related applications should take place within hospitals so that it reaches the largest possible number of workers, and incentives in the form of certificates or other benefits should be provided to the trainees. Proper training increases familiarity, and thus acceptance and use of technology. An appropriate number of trainers in specific fields should be put in place to train service providers, either from within the sector or through external secondments.
- **Spreading awareness:** There should be actions taken to activate the media aspect of hospitals in order to spread awareness among workers about the importance of information technology and its impact on productivity, which hospital managers at all levels must be familiar with, including theoretical knowledge of electronic applications, their advantages, and ease of use.

6.4.2.6 Financing

Officials should be interested in using information technology to develop hospital procedures, making it a priority in their plans, and ensuring the necessary funding by integrating strategies into hospital plans, using available resources, and rationalizing spending.

6.5 Findings and Their Relationship to the UTAUT Framework

The findings from the current study provide important insights into different aspects of the Libyan health sector, such as performance expectancy, effort expectancy, social influence, and facilitating conditions, to help determine which are most influential under the UTAUT framework on the use of EHRs in health facilities in Libya. It was observed through analysis that PE and EE were the strongest predictors among the behavioral intention variables, which aligns with the foundational framework proposed by Venkatesh et al. in 2003, which indicates that these two components are crucial for the acceptance of a given technology.

However, while Venkatesh et al. (2003) determined that SI has a moderate effect on BI, this study did not validate that fact, and thus it is concluded that SI did not significantly influence professionals' intentions to adopt EHRs. Such findings are consistent with other literature; for instance, Cimperman et al. (2016) also found that SI did not significantly influence technology adoption in a health care setting, which can be partly explained by the differences in cultural or organizational settings where these various studies were conducted. In addition, the professional independence of healthcare practitioners in Libya may reduce the influence of colleagues or social networks, compared to more hierarchical systems in different parts of the world.

In a related context, facilitating conditions (FCs), which are considered to be one element that may facilitate technology adoption by providing necessary support and resources, did not show any significant impact in the current research. This finding contradicts the findings of other

studies, such as that by Tavares et al. (2018), which found that FCs have a moderate influence on BI in adopting EHRs. Therefore, FCs, as asserted in this study, may be argued to have little influence on the adoption of EHRs due to the low technological infrastructural levels within Libyan health care institutions, which result in an insufficiency of technical resources and training, hence making FCs less influential by nature.

Moreover, ANX has been proven to be an important determinant of BI for health professionals, which reinforces the findings of Venkatesh and Bala (2008) that Anxiety is a significant inhibitor of technology adoption. Apprehension regarding the use of new and still-evolving technologies in countries like Libya, where EHR systems are still in the early stages of evolution, can be related to inadequate training and an overall lack of experience with information technology systems.

This study suggests that while the UTAUT model offers an inclusive theoretical framework to understand technology adoption, its application in Libyan healthcare organizations reveals unique dynamics which were invisible before. The findings also support the consideration of local contextual factors like technological infrastructure, cultural values, and organizational setup in implementing models of technology acceptance such as UTAUT.

6.6 Significance and Contributions of the Study

This research makes notable theoretical and practical contributions by examining the implementation of electronic health records (EHRs) within Libyan healthcare organizations through the lens of the Unified Theory of Acceptance and Use of Technology (UTAUT).

6.6.1 Theoretical Contributions

A significant aspect of this study is its utilization of the UTAUT framework within the healthcare system of a developing nation, specifically Libya. Although the UTAUT model has

received widespread application across various settings, this study applies the theory in a region with healthcare infrastructure is still evolving, as well as cultural and organizational barriers that may be quite different compared to more developed countries. The findings contribute to the current body of literature by demonstrating that performance expectancy and effort expectancy are still major drivers for technology adoption in this context, similar to the findings of Venkatesh et al. (2003).

On the other hand, the study also found results that deviate from the original model of UTAUT in terms of social influence and facilitating conditions, which in this case were found to be less important. These findings thus tend to weaken the assumption of general applicability for such factors and point to the need for context-specific adjustments of technology adoption models.

Moreover, the finding that anxiety significantly affects behavioral intention is consistent with prior research (Venkatesh & Bala, 2008), thus indicating the necessity for further investigation of the emotional dimensions within technology acceptance models in environments where technological infrastructure is still underdeveloped.

Through the investigation of these factors, the study enriches both the theoretical understanding of the UTAUT model and its practical applicability within various health systems. Lessons learned from the Libyan experience, especially with respect to the need to adapt the strategy of technology adoption to suit specific conditions, may inform activities in other regions facing similar infrastructural and cultural obstacles in the process of technology adoption.

6.6.2 Practical Contributions

From a practical standpoint, this study contributes much-needed insight into the efforts of policymakers, healthcare administrators, and information technology professionals to implement

health information technologies. The findings of this research can guide evidence-based practices that are supported by specific data relevant to the Libyan context by identifying critical EHR adoption barriers in Libyan healthcare institutions as well as ways by which they can be addressed, including the need for better training and infrastructure support, better funding, and the development of a comprehensive legal framework. The findings also identify the importance of performance expectations, effort expectations, and other factors crucial to increasing the probabilities of successful EHR implementation, which will provide a firm basis for decision-makers and policymakers to build a broad and robust strategy oriented towards the Libyan case. Moreover, this research serves as a critical reference for case studies of other developing countries facing similar challenges within their health sectors, since the lessons learned from the case of Libya, such as strategies for implementing technology tailored to local conditions, can strengthen efforts in regions facing comparable systemic and cultural barriers to the adoption of technology.

6.7 Limitations

Acknowledging the limitations of the study is essential for scientific integrity and paves the way for future research to address these shortcomings (Price & Murnan, 2004). This process allows future studies to work off from what is presented within the current findings, thereby providing a comprehensive model approach for the potential achievements of these studies. Such an approach can make a huge difference in the research conducted, and guarantee accomplishment of the intended benefits. The limitations of the research are outlined as follows.

One: Sample size and generalizability. Because this is a case study involving only a small number of personal interviews, in this case 16, it is difficult to generalize the findings from this study. Even though the interviews were instrumental in offering deep insights, they might

not sufficiently represent a bigger population, especially since interview findings are not necessarily representative of the wider community from which the sample is drawn. To reduce this problem, the research relied on more than one source of data (the principle of triangulation), such as a questionnaire. However, interviews remain a primary data source for this research, and broader future studies would be beneficial.

Two: Purposive sampling. Although this method is good in targeting specific and knowledgeable participants, it may result in a selection bias within the process. This approach focuses on a sector that is likely to provide relevant information with the highest likelihood, but it is likely to miss others who might also provide some very important views, thus giving an incomplete understanding of the phenomenon. Although the researcher believes sufficient evidence was provided regarding the conclusions reached at the end of the study, future research should increase the sample size in order to represent better the diversity of the health care provider population and increase the generalizability of the findings.

Three: External generalizability. Due to the peculiarity of the health care system in Libya and the kind of conditions under which it is operating, more specifically since the revolution in 2011, it was rather difficult to attain external generalizability. In this regard, particular Libyan social, political, and economic conditions may influence the way by which e-health solutions are adopted and implemented in such a way that could not be generalized elsewhere. However, the research results and the analysis method can be used to guide the study of other countries seeking to use information technology in their health systems.

Four: Private Sector Participation. This research focused mainly on the Libyan health system's public sector, with little regard to the role of the private sector, which has seen tremendous growth during the last two decades, as pointed out in Chapter Four. This has made it

a key factor in the provision and quality of health services, and hence requires engagement for future studies of health IT adoption to appreciate the broader impacts and challenges across the whole health system.

Five: Narrow focus. This research was focused on the supply side, and thus mostly ignored the demand side. For instance, the study gave attention to the attitudes of health service providers regarding the use of electronic health records, in addition to technological and institutional structures, among others, but it did not address the aspect of health service beneficiaries, i.e., the patients, in the acceptance of this technology. Therefore, patients' behaviors and attitudes towards e-health should be explored in future research for a more comprehensive understanding of technology acceptance in health care.

6.8 Chapter Summary

This chapter presented the findings of the research, which was aimed at handling the weaknesses of Libyan health services through the proposal of electronic health records (EHRs). The research aims at investigating, among other things, the general status of the Libyan health sector, problems to be faced in adopting electronic health records, and the potentials for the application of electronic health information technology (HIT). Using qualitative and quantitative methods, it identified several challenges related to such adoption: poor technology infrastructure, cybersecurity risks, and lack of necessary training and creation of health provider awareness. The chapter also discussed some strategies identified by the research for facilitating the successful adoption of health information technology in Libya. Finally, the chapter concluded with an acknowledgment of the limitations of this research.

Chapter Seven

7.1 Conclusion

The utilization of electronic health records in Libya presents a great opportunity to improve the quality of its health services. Nevertheless, various challenges have to be overcome, which range from weak technological infrastructure and cybersecurity threats to resistance to change and the general lack of necessary training and awareness in the healthcare sector. In addition, financial issues and the lack of a relevant legal framework further hamper the adoption process. The benefits that EHRs offer in efficiency, reduced medical errors, and better care coordination make it a pursuit worthy of the effort, even with the existence of such challenges, and therefore it was incumbent to develop a comprehensive strategy to help address these barriers and promote the successful implementation of EHRs in Libyan hospitals. This study has identified a number of strategies crucial to promoting EHR adoption in Libya. These strategies are divided into fundamental and hospital-specific strategies that in combination offer a comprehensive roadmap for the effective implementation of health information technology.

Foundational strategies at the national level are essential in setting the stage for the successful adoption of EHRs across the country, and the most important element is the creation of an e-health administration sub-department in the Libyan Ministry of Health. This department will be in charge of guiding all activities regarding the implementation of EHRs in terms of planning, technical support, and continuity of the program. To enhance the effectiveness of this department, there needs to be affiliated offices in the six administrative regions which can facilitate the department's operations and make support more accessible.

There is a need to build a strong legal framework. This framework should be inspired by successful regulations and laws in other countries that have experience in the field of e-health,

and that are adjusted to suit Libyan society. The framework will clearly stipulate guidelines on data security and privacy and interoperability standards and assist in the safe and effective use of electronic health records.

The Ministry of Health should follow the route of electronic transformation through embracing information technology in managing the health sector. This includes the implementation of various electronic applications for management and governance, encouraging institutions within the sector to adopt health information technology, and promoting a culture of innovation and efficiency.

A comprehensive, clearly defined national strategic plan for EHR adoption is very necessary. This will call for an in-depth assessment of the current technological infrastructure, identifying gaps and upgrading systems to equip them with compatibility for the new EHR system. Engaging all stakeholders relevant to this program from the very beginning, relating to healthcare practitioners, medical laboratories, pharmacies, and medical imaging centers, is very important for its smooth implementation.

There should be some specific strategies at the hospital level to create a conducive environment for this adoption. A strong technological infrastructure needs to be built and constantly maintained, and integrated internal networking has to be established in hospitals to help in information exchange and in carrying out day-to-day operations. High-speed Internet and well-equipped computers should be installed at various points within each hospital to ensure accessibility for all staff.

Attention has to be focused on the hospitals' IT departments. These should be well equipped with resources, such as programmers and other staff that can help in maintenance and

development. Teamwork between the different hospitals should be practiced in order to encouraged knowledge-sharing, therefore increasing the technological capability overall.

It is also important to create an enabling work environment for the use of technology. A good example of this involves offering constant training to health professionals to update their skills and knowledge on the use of EHR systems. Promoting policies related to IT usage, such as making high-speed Internet available, providing computers in hospital libraries, and setting up electronic portals for administrative and financial services, would probably encourage employees to make better use of the technology.

On the other hand, there are various applications for different departments that have to be selected and implemented in order to create an environment that is technologically integrated. These range from laboratory applications to medical imaging and pharmacy procedures, appointment management systems, and other applications that will streamline all aspects of hospital operations and efficiency.

In-house technology training programs would reduce anxiety and make staff more welcoming to such technology. If there is a greater focus on effort expectancy, performance expectancy, and anxiety, then this will have a positive effect on attitudes toward the adoption of technology, and hence would make the implementation process smoother. There is no doubt that hospitals following these strategies will find the quality of their services improved and make them appropriate environments to accept the use of electronic health records when they are adopted at the national level.

The hope is that those responsible at all levels will be interested in this and other research toward developing the health sector. With the effective movement of the world into a new era,

the use of artificial intelligence and machine learning in the health sector and other sectors to keep up with scientific development is already at hand.

7.2 Future Research

When examining the limitations of the research, several topics were identified that would be useful to consider in future studies, including some that would contribute to addressing the research problem and questions from different angles. These results therefore pave the way for new research to address the problem of weak health services, which affects society in Libya and many other countries.

The researcher proposed the adoption of electronic health systems in the Libyan health system, in particular Electronic Health Records (EHRs), that will improve the health services and eradicate a large portion of the problems in this sector. Utilization of this technology is, however, faced with a number of obstacles. In order to identify these obstacles, the case study research focused on four Libyan health institutions, and included study of the human element, the technological infrastructure aspect, the institutional aspect, and others in a bid to determine a strategy that can contribute to addressing the challenges involved.

Regarding the human element, the research looked at the attitudes of service providers regarding the use of health information technology in these hospitals, but future studies would benefit from investigating the extent to which patients accept this technology, in addition to identifying the factors that influence their acceptance. This would ensure a comprehensive understanding of the successful adoption of this technology in Libyan health institutions from various perspectives, maximizing the benefits of such adoption.

Moreover, future research with a larger number of hospitals, and from different cities, will undoubtedly provide more information about those hospitals and the factors that affect the

adoption of health information technology in the preparation of an integrated strategy for electronic health record adoption.

Future research should also explore the private sector, which has grown rapidly in the last two decades and has become an influential element in the Libyan health system. Understanding the factors affecting this sector's adoption of health information technology will thus ensure the development of a general strategy that considers all components of the Libyan health system.

The results of the research also revealed the presence of other factors that may not be related to health information technology in particular, but by addressing them would help in solving the larger problem the research seeks to solve or mitigate, i.e., “weak health services.” One such issue is imbalance and surplus within the healthcare workforce. The research indicates that there is a notable oversupply in certain specializations, alongside a lack in others. This imbalance can be attributed to employment practices that prioritize reducing unemployment and mitigating associated social issues over meeting the actual needs of the healthcare sector. Consequently, the labor market outputs do not meet the needs of the sector, leading to inefficiencies in service delivery. Addressing this problem requires a more strategic approach to employment in the healthcare sector, and workforce planning that is based on economic considerations and the sector's needs. Future economic research can therefore play a pivotal role in solving this problem by identifying effective strategies to balance the workforce.

Future research should also consider how it can contribute to establishing a relevant legal framework for e-health in Libya by highlighting crucial issues, utilizing existing frameworks, and addressing other legal concerns. This will enable the relevant authorities to construct a framework that is compatible with Libyan society.

For continuation of this research, Tripoli Medical Hospital (University Hospital) and Al-Khadhra Hospital are recommended as experimental subjects to model the adoption of electronic health records. This can be achieved by taking advantage of the hospitals' strategy and insights gained from this research to develop an actionable plan. Supporting this initiative would require investment in the infrastructure of these hospitals and obtaining their requirements directly from one or more specific parties, such as the Ministry of Health, oil companies, communications providers, municipalities, or government. A specialized committee must also be identified to assume responsibility for planning, follow-up, and implementation.

Once the pilot project is implemented, the concept can be employed in other hospitals. For example, if support is required from Libya's 108 municipalities, then the groups of municipalities within the country's six health regions can support hospitals located within their own regions.

Providing these hospitals them with the necessary support, closely monitoring implementation, and ensuring the continuity of operations will significantly increase the likelihood of success. For instance, support for the use of applications that help in day-to-day operations, such as scheduling and organizing appointments, linking laboratories, medical imaging centers, and pharmacies to hospitals, in addition to electronic archiving of patient files, will contribute to improving the health services provided in these hospitals. These benefits also extend to administrative efficiency, thereby helping in improved management of these hospitals.

Patients will receive simplified services, such as booking specialist appointments online or via phone, and receiving diagnostic results electronically without the need to revisit the hospital in non-emergency cases. This approach reduces patient visits, alleviating pressure on doctors and allowing them to focus on delivering higher-quality care to patients. Electronic

health records (EHRs) will also empower patients, especially those with chronic or advanced conditions, by giving them access to physicians' notes and facilitating direct interaction through comments on their health records. This feature enhances engagement, speeds up access to medical advice, and improves overall health outcomes.

Moreover, adopting these electronic applications will encourage private pharmacies, laboratories, and medical imaging centers to link with hospitals, allowing them to market their services more effectively to local patients. This interconnected system accelerates the adoption of e-health applications and facilitates the exchange of electronic health information, including electronic prescriptions, lab results, and imaging data (Menachemi & Collum, 2011). For example, electronic prescriptions reduce errors caused by illegible handwriting, minimize the risk of prescribing medications that cause allergies, and ensure adherence to prescribed treatments (Heart et al., 2017). These applications further enhance patient safety by enabling direct communication between pharmacists and treating physicians.

With adequate support, these hospitals can also address potential labor imbalances by retraining staff for required specialties. For example, some nursing staff could be requalified as midwives, and surplus administrative personnel could be reassigned to service roles or other needed areas. Continuous training programs to improve workforce efficiency, fostering cooperation between health institutions to exchange expertise, and linking performance to efficiency metrics will optimize resource utilization within hospitals.

The feasibility of this concept is strongly supported by the research findings. The researcher therefore recommends implementing this pilot study in the identified hospitals, as this initiative has the potential to serve as the foundation for broader adoption of e-health solutions across Libya's healthcare system.

In conclusion, this research contributes to the understanding of issues related to the utilization of health information technology in the Libyan health system, and how it can help in the betterment of health services. As a result of this research, a number of obstacles which would hinder the adoption of this technology in health institutions and the Libyan health system were discovered. The research also presented an array of strategies that can confront these challenges and help in the successful adoption of this technology. This study provides a core for future research toward determining other factors that would improve the level of health services and assist the work of the various specializations involved in the health sector.

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Appendices

Appendix A: Ethical Approval

24/12/2021

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

Numéro du dossier / Ethics File Number	H-11-21-7417
Titre du projet / Project Title	Exploring Opportunities and Challenges of E-health adoption in Libya
Type de projet / Project Type	Thèse de doctorat / Doctoral thesis
Statut du projet / Project Status	Approuvé / Approved
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	24/12/2021
Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	23/12/2022

Équipe de recherche / Research Team

Chercheur / Researcher	Affiliation	Role
Emad ELFITURI	École de science informatique et de génie électrique / School of Electrical Engineering and Computer Science	Chercheur Principal / Principal Investigator
Rocci LUPPICINI	Département de communication / Department of Communication	Superviseur / Supervisor

Conditions spéciales ou commentaires / Special conditions or comments

550, rue Cumberland, pièce 154 550 Cumberland Street, Room 154
Ottawa (Ontario) K1N 6N5 Canada Ottawa, Ontario K1N 6N5 Canada

613-562-5387 • 613-562-5338 • ethique@uOttawa.ca / ethics@uOttawa.ca
www.recherche.uottawa.ca/deontologie | www.recherche.uottawa.ca/ethics

24/12/2021

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

Le Comité d'éthique de la recherche (CÉR) de l'Université d'Ottawa, opérant conformément à l'*Énoncé de politique des Trois conseils* (2014) et toutes autres lois et tous règlements applicables, a examiné et approuvé la demande d'éthique du projet de recherche ci-nommé.

L'approbation est valide pour la durée indiquée plus haut et est sujette aux conditions énumérées dans la section intitulée "Conditions Spéciales ou Commentaires". Le formulaire « Renouvellement ou Fermeture de Projet » doit être complété quatre semaines avant la date d'échéance indiquée ci-haut afin de demander un renouvellement de cette approbation éthique ou afin de fermer le dossier.

Toutes modifications apportées au projet doivent être approuvées par le CÉR avant leur mise en place, sauf si le participant doit être retiré en raison d'un danger immédiat ou s'il s'agit d'un changement ayant trait à des éléments administratifs ou logistiques du projet. Les chercheurs doivent aviser le CÉR dans les plus brefs délais de tout changement pouvant augmenter le niveau de risque aux participants ou pouvant affecter considérablement le déroulement du projet, rapporter tout événement imprévu ou indésirable et soumettre toute nouvelle information pouvant nuire à la conduite du projet ou à la sécurité des participants.

The University of Ottawa Research Ethics Board, which operates in accordance with the *Tri-Council Policy Statement* (2014) and other applicable laws and regulations, has examined and approved the ethics application for the above-named research project.

Ethics approval is valid for the period indicated above and is subject to the conditions listed in the section entitled "Special Conditions or Comments". The "Renewal/Project Closure" form must be completed four weeks before the above-referenced expiry date to request a renewal of this ethics approval or closure of the file.

Any changes made to the project must be approved by the REB before being implemented, except when necessary to remove participants from immediate endangerment or when the modification(s) only pertain to administrative or logistical components of the project. Investigators must also promptly alert the REB of any changes that increase the risk to participant(s), any changes that considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project or the safety of the participant(s).

Kim THOMPSON

Responsable d'éthique en recherche / Protocol Officer

Pour/For **Daniel LAGAREC** Président(e) du/ Chair of the **Comité d'éthique de la recherche en sciences de la santé et sciences / Health Sciences and Sciences Research Ethics Board**

550, rue Cumberland, pièce 154 550 Cumberland Street, Room 154
Ottawa (Ontario) K1N 6N5 Canada Ottawa, Ontario K1N 6N5 Canada

613-562-5387 • 613-562-5338 • ethique@uOttawa.ca / ethics@uOttawa.ca
www.recherche.uottawa.ca/deontologie | www.recherche.uottawa.ca/ethics

Appendix B: Request for permission to conduct scientific research.



Université d'Ottawa | University of Ottawa

Département de communication | Department of Communication

55 Laurier E. (DMS 11125)
Ottawa ON Canada K1N6N5
Tél. : 613-562-5800 X8971
Télec. : 613-562-5240

55 Laurier E. (DMS 11125)
Ottawa ON Canada K1N 6N5
Tel.: 613-562-5800 X8971
Fax : 613-562-5240

Appendix:

Jun 12, 2022

Subject: Request for permission to conduct a scientific research.

The supervisor's name: Rocci Luppigini,

The researcher's name: Emad Elfituri,

To the health institution:

Mr. Elfituri is conducting PhD research from the University of Ottawa, Canada, under the title: Exploring Opportunities and Challenges of E-health adoption in Libya.

He aims to collect knowledge that will help develop a strategy for implementing electronic health records in Libyan health institutions, as this technology is one of the most important electronic health applications that many countries have succeeded in adopting due to its effectiveness in improving the quality of health services.

To obtain the required information, the study includes distributing a questionnaire and conducting personal interviews with some of the expertise in your esteemed institution.

Please find attached a copy of the research brief, questionnaire, and the interview questions.

I am looking forward for your cooperation and permission for Mr. Elfituri to access the necessary facilities and collect the data required for the research.

Sincerely,

Rocci Luppigini

Director (Arts), Tri-Faculty Graduate Program, Digital Transformation and Innovation,
University of Ottawa

55 Laurier E. (DMS 11125)

Ottawa ON K1N 6N5

tel: (613)562-5800 X8971

Email: rluppici@uottawa.ca

<http://arts.uottawa.ca/communication/en/people/luppigini-rocci>

Appendix C: University Hospital Approval (in Arabic)

STATE OF LIBYA
TRIPOLI UNIVERSITY HOSPITAL



دولة ليبيا
المستشفى الجامعي طرابلس

الإشاري: Index :

التاريخ: 24/5/22 Date :

إلى من يهمه الامر

بسم (الله) رب العالمين

بناءً على موافقة مدير عام المستشفى الجامعي طرابلس على الطلب المقدم من السيد / عماد الهادي الفيتوري للتعاون معه لإجراء بعض المقابلات الشخصية وتوزيع إستبيان داخل المركز لأستكمال بحثه العلمي للحصول على درجة الدكتوراه عليه "....." نأمل منكم التعاون مع المعنى لأستكمال بحثه والله الموفق وذلك خلال الفترة من 2022-8-5 إلى غاية 2022-1-5

شاكرين حسن تعاونكم

والله اعلم

www.tuh.med.ly
info@tuh.med.ly

طريق عين زارة الفرنج - طرابلس / ليبيا

+218 21 462 3701-15 ☎ +218 21 462 5615 ☎ 7425 ☎

Appendix D: National Heart Center Approval (in Arabic)

Libyan/Ministry of Health
National Heart Center
Tripoli - Tajoura



دولة ليبيا
وزارة الصحة
المركز الوطني للقلب
طرابلس - تاجوراء

التاريخ : 14 / /
الموافق : 8 / 14 / 2022 م

الرقم الإشاري :

الى من يهمه الامر

بعدم التحيّة ..

بناءً ... على موافقة مدير عام المركز على الطلب المقدم من السيد/ **عماد الهادي الفيتوري**
للتعاون معه لإجراء بعض المقابلات الشخصية وتوزيع استبيان داخل المركز لاستكمال بحثه
العلمي للحصول على درجة الدكتوراه.

عليه ... نأمل منكم التعاون مع المعني لاستكمال بحثه والله الموفق.

شاكرين حسن تعاونكم

والسيد (عليكم) السلام



Appendix E: Tripoli Central Hospital Approval (in Arabic)

MINISTRY OF HEALTH TRIPOLI CENTRAL HOSPITAL	دولة ليبيا حكومة الوحدة الوطنية وزارة الصحة مستشفى طرابلس المركزي	
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التاريخ: 2022, 8, 3 الموافق: / /	الرقم الاشاري: 8/214
-------------------------------------	----------------------

السيد / عماد الهادي الفيتوري
اسم المشرف / روكي لوبيتشيني
 بعد التحية ،،،

لقد تمت الموافقة من قبل المدير العام على منحكم فرصة استكمال البحث
 العلمي في درجة الدكتوراة من جامعة أتاوا ، كندا ، تحت عنوان : استكشاف فرص وتحديات
 تبني الصحة الالكترونية في ليبيا .

،،،، شاكرين لكم حسن تعاونكم معنا ،،،،

الى :
 مكتب تنمية الموارد البشرية
 ب.م.س. ،،،

عنوان : مستشفى طرابلس المركزي - شارع السيدي : 2751 هاتف : 10 - 218 21 3605001 فاكس : 218 21 3604936
 Tripoli Central Hospital Address : E L SAIDI STREET P.O.Box : 2751 TEL : +218 21 3605001-10 FAX : +218 21 3604936
www.tch.med.ly

Appendix F: Al Khadra Hospital Approval (in Arabic)



دولة ليبيا
وزارة الصحة
مستشفى الخضراء العام
AL KHADRA GENERAL HOSPITAL



نموذج رقم (16)

Date: 2022 8/10 التاريخ

الرقم البشري: 5150

السيد البروفيسور / روكي لوبيتشيني
مدير برنامج الدراسات العليا ثلاثي الكليات ، التحول الرقمي والابتكار
جامعة اتاوا - كندا

بعد التحية،،،

رداً على كتابكم بشأن طلب الموافقة للسيد الطالب / عماد الفيتوري -
الحصول على المعلومات المطلوبة لاتمام بحثه في مجال دراسته لنيل درجة
الدكتوراة من جامعة (اتاوا) . كندا .

عليه تفيدكم ادارة المستشفى بالموافقة على السماح للمعني استكمال اجراء
البحث تحت عنوان (استكشاف فرص وتحديات تني الصحة الالكترونية في ليبيا) .

هكذا للعلم للاهمية بطلب الحضور وعدم المخالفة

الهضبة الخضراء - طرابلس ☎ صندوق البريد طرابلس 278 ☎ البريد المصور: +218 21 4906030 ☎ +218 21 4900752-4

AL KHADRA HOSPITAL AL HADBA - Tripoli ☎ P.O.Box 278. Tripoli ☎ +218 21 4900752-4 ☎ +218 21 4906030

Appendix G: Advertisement

Invitation to Participate in Questionnaire

To the hospital staff:

Doctors, Nurses, Health professionals, Administrators IT staff.

You have been invited to participate in this research questionnaire.

My name is Emad Elfituri, and I am conducting a PhD study from the University of Ottawa, Canada, under the title: Exploring Opportunities and Challenges of E-health adoption in Libya.

The research aims to gather knowledge that would help lay down a strategy to implement electronic health records in the Libyan health institutions, as this technology is one of the most important electronic health applications many countries have intended to introduce given their effectiveness in improving the quality of the health services.

This questionnaire represents one of the important aspects of the research to identify the factors that affect the adoption and use of these records in Libyan health institutions.

Please be aware that all participants shall receive complete anonymity and that all answers will be treated with complete confidentiality and will only be used for scientific research purposes. If you would be so kind to fill out the questionnaire that would be much appreciated.

In my estimation it ought to take about 15-20 minutes to fill out the questionnaire. We thank you for your cooperation and confirm that your answers have an important impact on the accuracy of the results, and achievement of the research objectives.

The researcher will be available to distribute the questionnaire form in room No. (---) as of the date ----- during the following times (.....). Please fill out the questionnaire and return it to the same room or contact the researcher.

We are looking for 40 participants, first-come, first served.
Should you need anything at all clarified, please feel free to send me an email at:
email: -----, or contact: phone# ----- WhatsApp/ Viber: -----

Yours sincerely,
Emad Elfituri

Appendix H: Advertisement/ Invitation to Participate in Questionnaire (in Arabic)

اعلان للمشاركة في استبانة لإجراء بحث علمي لنيل درجة الدكتوراه

الإخوة والاخوات: الاطباء، والتمريض، والمهنيون الصحيون، والإداريون.

بعد التحية:

أنتم مدعون للمشاركة في هذه الاستبانة للمشاركة في بحث علمي بعنوان:

استكشاف الفرص والتحديات لتبني الصحة الالكترونية في ليبيا

Exploring Opportunities and Challenges of E-health adoption in Libya

Researcher name: Emad Elfituri
Supervisor name: Rocci Luppacini
University of Ottawa – Canada

اسم الباحث: عماد الهادي الفيتوري
اسم المشرف: روكي لابيثنوي
جامعة اتاوا – كندا

يهدف البحث إلى جمع المعرفة التي من شأنها أن تساعد في وضع استراتيجية لتنفيذ السجلات الصحية الإلكترونية (EHRs) في المؤسسات الصحية الليبية، حيث تعد هذه التقنية من أهم التطبيقات الصحية الإلكترونية التي اعتمدتها العديد من الدول نظرًا لفعاليتها في تحسين جودة الخدمات الصحية.

تمثل هذه الاستبانة أحد الجوانب المهمة للبحث للتعرف على العوامل التي تؤثر على اعتماد واستخدام هذه السجلات في المؤسسات الصحية الليبية.

يرجى العلم أن جميع المشاركين سيحصلون على سرية تامة وأن جميع الإجابات ستعامل بسرية تامة ولن تستخدم إلا لأغراض البحث العلمي. إذا كنت ترغب في ملء الاستبانة، فسيكون ذلك موضع تقدير كبير. يستغرق ملء الاستبانة حوالي 15 دقيقة.

نشكرك على تعاونك ونؤكد أن إجاباتك لها تأثير هام على دقة النتائج وتحقيق أهداف البحث.

يتواجد الباحث لتوزيع استبانة الاستبانة في الغرفة رقم (----) اعتباراً من تاريخ ----- خلال الأوقات التالية (.....).

يرجى تعبئة الاستبانة وإعادتها الي نفس الغرفة أو الاتصال بالباحث.

ملاحظة: نتطلع للحصول على 40 مشارك ومشاركة من مختلف التخصصات.

إذا كنت بحاجة إلى أي توضيح أو استفسار، يرجى الاتصال بالباحث عبر إحدى الوسائل التالية:

WhatsApp / Viber: ----- Email: -----

تفضلوا بقبول فائق الاحترام والتقدير،

عماد الفيتوري

Appendix I: Consent Form (Questionnaire)

Dear respondent,

My name is Emad Elfituri, and I am conducting a PhD study from the University of Ottawa, Canada, under the supervision of Dr. Rocci Luppigini, titled: Exploring Opportunities and Challenges of E-health adoption in Libya.

Purpose: The purpose of this research is to gather knowledge that would help lay down a strategy to implement electronic health records in the Libyan health institutions, as this technology is one of the most important electronic health applications that would improving the quality of the health services.

Invitation to Participate: I invite you to participate in this questionnaire, which represents one of the important aspects of the research to identify the factors that affect the adoption and use of these records in Libyan health institutions.

Procedure: Those agreeing to participate in the questionnaire expect the following to happen. After the consent form has been read, you will fill out a structured questionnaire consisting of a short-answer questions. The questionnaire takes about 15 minutes to complete.

Risks: The researcher has assured the participant that there are no known risks involved in participating in this study.

Benefits: In participating in this study, the participant will not only be aiding the researcher in exploring opportunities and challenges of EHRs adoption in the Libyan health institution, but also in furthering the understanding of e-health solutions and its impact within healthcare settings.

Conservation of data: The data collected by using the questionnaires, interviews, tape recorder and notes by the researcher will be kept in a secure manner. The data will be kept for five years and only the researcher and supervisor will have access to it in this time. At the end of five years, they will be destroyed.

Confidentiality: All data produced from the study will be stored securely. Only the researcher and supervisor will have access to the data. Any information that may identify participants such as job titles and/ or positions will not be disclosed in the publications. The research will refer to the specializations that participated in general (e.g., doctors, nurses, health technicians, administrators, etc.). The questionnaires will not contain any

personal identifiers that could be linked to the participant. The names of the hospital will be revealed in publications (Only if the hospital approval is obtained).

Voluntary Participation: It is your choice to take part in the study. There will be no penalty if you chose to not participate or to stop participation at any time during the research project.

Acceptance: By completing and returning the survey, I am consenting to participate in this research study.

If there are any questions about the study, the participant may contact the researcher or his supervisor. There are two copies of this consent form, one of which is the participant to keep.

Contact Information

Researcher: Emad Elfituri,
Telephone: ----- or WhatsApp/ Viber: -----
Email: -----

Supervisor: Rocci Luppacini: University of Ottawa, Canada
Telephone: -----
Email: -----

Research Ethics Board (University of Ottawa)

If you have any questions regarding the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 154, Ottawa, ON. K1N-6N5, Canada; Tel.: 613-562-5387; Email: ethics@uottawa.ca

Appendix J: Consent Form (Questionnaire) in Arabic

نموذج موافقة على المشاركة في استبانة بحثية

عزيزي المشارك،

بعد التحية:

تعد هذه الاستبانة جزء من بحث علمي بعنوان:

استكشاف الفرص والتحديات لتبني الصحة الإلكترونية في ليبيا

Exploring Opportunities and Challenges of E-health adoption in Libya

Researcher name: Emad Elfituri
Supervisor name: Rocci Luppacini
University of Ottawa – Canada

اسم الباحث: عماد الهادي الفيتوري
اسم المشرف: روكي لوبيتشيني
جامعة أوتاوا – كندا

الغرض من البحث: جمع المعرفة التي من شأنها أن تساعد في وضع استراتيجية لتنفيذ السجلات الصحية الإلكترونية في المؤسسات الصحية الليبية، حيث تعد هذه التقنية من أهم تطبيقات الصحة الإلكترونية التي من شأنها تحسين جودة الخدمات الصحية.

الإجراءات: أولئك الذين يوافقون على المشاركة في هذه الاستبانة عليهم أولاً قراءة نموذج الموافقة، ثم سيطلب منهم ملء استبانة تتكون من مجموعة أسئلة تستغرق الإجابة عليها حوالي 15-20 دقيقة.

المخاطر المتوقعة: يؤكد الباحث للمشارك أنه لا توجد أي مخاطره متوقعة تتعلق بالمشاركة في هذه الدراسة.

الفوائد المتوقعة: هي فرصة لتبادل المعارف والخبرات والتصورات مما يعطي المشارك فكرة أكبر على تطبيقات الصحة الإلكترونية وفوائدها في تحسين مستوى الخدمات الصحية. كما أنه من خلال مشاركتك ستساهم أيضاً في توفير معلومات تساعد على وضع إستراتيجية لتبني السجلات الصحية الإلكترونية في المؤسسات الصحية الليبية من أجل تطوير وتحسين مستوى الخدمات الصحية بها.

حفظ البيانات: سيتم حفظ جميع البيانات التي يتم جمعها بطريقة آمنة. كما أنه سيتم الاحتفاظ بها لمدة خمس سنوات وسيتمكن الباحث والمشرف فقط من الوصول إليها في هذا الوقت. في نهاية الخمس سنوات سيتم التخلص من هذه البيانات بالطريقة الصحيحة.

السرية: سيتم تخزين جميع البيانات التي يتم جمعها بشكل آمن، وسيتمكن الباحث والمشرف فقط من الوصول إلى هذه البيانات، والتي تشمل التسجيلات الصوتية، والنصوص، وأي ملاحظات مكتوبة من قبل الباحث. وسيتم استخدام هذه المعلومات في تحليل البيانات وكتابة الدراسة ولن يتم الكشف عن أي معلومات قد تحدد هوية المشاركين مثل المسميات الوظيفية و / أو المناصب في المنشورات. حيث سيشير البحث إلى التخصصات التي شاركت بشكل عام (مثل الأطباء والتمريض وفنيي الصحة والإداريين ... إلخ). وسيتم الكشف عن أسم المستشفى أو المؤسسة الصحية في المطبوعات (فقط في حالة الحصول على موافقة منها). كما سيتم استخدام علامات الاقتباس المجهولة في نشر النتائج.

المشاركة الطوعية: إن تطوعك لإجراء هذه الاستبانة اختياري ولن تكون هناك أي عواقب إذا اخترت عدم المشاركة أو إيقاف مشاركتك في أي وقت أثناء مشروع البحث.

القبول: بملء الاستبانة وإعادتها، أوافق على المشاركة في هذه الدراسة البحثية المذكورة أعلاه التي يجريها الباحث عماد الهادي الفيتوري من جامعة أوتاوا، والتي تخضع لإشراف البروفيسور روكي لوبيتشيني.

هناك نسختان من نموذج الموافقة، أحدهما للمشاركة.

في حالة وجود أي أسئلة حول الدراسة، يمكن للمشاركة الاتصال بالباحث أو المشرف.

هذه الدراسة قد تمت مراجعتها والموافقة عليها من قبل مكتب أخلاقيات البحث بجامعة أوتاوا. إذا كان لديك أي مخاوف أو استفسارات تتعلق بأخلاقيات البحث العلمي حول هذه الدراسة يمكنك الاتصال بالموظف المختص من خلال احدى الوسائل الموضحة ادناه:

Contact Information

Research Ethics Board (University of Ottawa):

If you have any questions regarding the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, Cumberland Street, Room 159, Ottawa, ON. K1N-6N5, Canada.

Tel.: 613-562-5387; Email: ethics@uottawa.ca

إذا كان لديك أي أسئلة أو استفسارات يمكنك الاتصال بالباحث أو المشرف من خلال احدى الوسائل الموضحة ادناه:

Researcher: Emad H M Elfituri: Email: -----

Telephone: ----- or WhatsApp/ Viber: -----

Supervisor: Rocci Luppigini: Email: -----

University of Ottawa, Canada: Telephone: -----

Appendix K: The Questionnaire**Part I: Personal information**

1- What is your age?

☐ <30 ☐ 30-40 ☐ 41-50 ☐ 51-60 ☐ 61 and more

2- For how long have you been practicing your job?

☐ 1- 4 years ☐ 5- 8 ☐ 9- 12 ☐ 13- 15 ☐ 16 and more

3- Gender: ☐ Male ☐ Female

4- What is your job in your medical institution?

☐ Doctor ☐ Health professional ☐ Nurses & Midwives

☐ Management ☐ Other, please specify.....

5- How would you describe your English language proficiency?

☐ Do not speak English ☐ Beginner ☐ Intermediate ☐ Advanced

Part II: the extent of using computerized health information system applications in the institution.

Please put an X in front of the appropriate answer.		Yes	No
1	The center uses a computerized system to record patient health information		
2	The center uses an electronic system to issue medical orders and request tests		
3	The center uses support electronic medical systems such as laboratory information system, pharmacy information system, radiology information system and nursing system.		
4	The center uses an electronic reminder system		

Part III: your personal expectancy of the ease of using the electronic health records system.

	Please specify your answer by placing an (X).	Highly Agree	Agree	Neutral	Disagree	Highly Disagree
1	I expect dealing with the EHRs system will be clear and understandable.					
2	I expect to find the system flexible during the use					
3	I expect learning to use the EHRs will not be complicated.					
4	I expect using the EHRs is easier than paper records and faster in terms of access and retrieval.					

Part IV: Your personal expectancy of the benefit of using the EHRs system.

1	I expect using this system will enable me to get tasks done more quickly.					
2	I expect using the system will improve my performance in my job.					
3	I expect using the system will enhance my effectiveness in my job.					
4	I expect the system will support clinical decisions as the physician can easily access the patient's medical history.					
5	I expect using the system will lead to greatly activate the e-services especially medical consultations.					
6	I expect using the system will improve patient safety and thus improve the level of health services.					
7	I expect using the system would save time, effort, and costs.					

Part V: The availability of factors that assist in adopting and using electronic health records.

1	The hospital infrastructure (internet, computers, security software, servers, etc.) has support to use the EHRs.					
2	Available laws and legislations support and regulate the use of the electronic health records.					
3	The hospital information technology staff can be relied upon for training, follow-up and solving problems that may face the system.					

Part VI: Social influence

1	The hospital's senior management encourages staff to use such applications (EHRs).					
2	There is a tendency from the Ministry of Health to use such applications in the hospitals.					
3	There is encouragement from colleagues to use HIT.					

Part VII: your personal perception of the state of anxiety associated with the use of the system.

1	I am concerned that using the electronic health records system may be complicated.					
2	It concerns me to think that I might lose a lot of information by pressing the wrong button.					
3	I do not like to use any electronic means to perform my work.					
4	Entering patient diagnostic data is complex and time consuming.					
5	I am concerned about facing a legal issue due to the loss or leakage of information from the system.					

Part VIII: Reflects the extent of your desire to use the electronic health records system if it is used in the institution.

Please specify your answer by placing an (X).		Highly Agree	Agree	Neutral	Disagree	Highly Disagree
1	I expect to use the system if it is provided by the institution.					
2	I expect to use the system, to improve the quality of the healthcare services.					
3	I expect to cooperate with my colleagues for successful use of the system and improve our health care services.					
4	I expect to use the system if it will improve my performance.					
5	I expect to participate in designing and implementing this system.					
6	It is a good idea to do my job or part of it through the electronic health records.					

Part IX: The computer skills and willingness to train.

Please indicate with an (X) the appropriate answer.

- 1- How would you rate your ability to use a computer for printing, scanning, and dealing with the basic programs of the office applications (Word, Excel...)?

☐ Novice ☐ Average ☐ Good ☐ Excellent

- 2- How frequently do you access a personal computer?

☐ Daily ☐ Weekly ☐ Monthly ☐ Never

- 3- Would you like to take a computer course to develop your skills or acquire new ones?

☐ Yes ☐ No, I do not need it. ☐ No, I do not have time. ☐ No, I have enough skills.

Part X: The EHRs knowledge, skills, and training opportunities.

- 1- Do you have previous knowledge of what the EHRs are, their importance, function, and the opportunities that they may achieve?

☐ Yes ☐ No

If yes, what is the source:

☐ Book ☐ Conference ☐ Magazine ☐ Internet ☐ Others.....

- 2- Have you ever been trained to use an EHR system or had any experience operating one?

☐ Yes ☐ No

If you have, what type of experience or training was it?

- 3- Would you like to take a training course on the EHRs to learn about their functions, benefits, and how to use them or develop your skills?

☐ Yes ☐ No, I do not need it. ☐ No, I do not have time. ☐ No, I have enough skills.

Part XI: The comments and recommendations.

- Please, write down below any thoughts, recommendations or comment you would like to add.

Appendix L: The Questionnaire (in Arabic)

استبانة خاصة بالأطباء والمرضى والفنيين الصحيين والإداريين ومتخصصي تك المعلومات

الخصائص الديموغرافية:

1 - يرجى تحديد اجابتك بوضع علامة (X) في الجدول ادناه:

الجنس/العمر	30 سنة او اقل	40 - 31	50 - 41	60 - 51	61 او أكثر
ذكر					
انثى					

2 - سنوات الخبرة:

سنوات الخبرة	3 سنوات او اقل	7 - 4 سنوات	11 - 8 سنة	15 - 12 سنة	16 سنة او اكثر

3 - يرجى تحديد الفنية التي تعبر عن طبيعة عملك من الجدول ادناه بوضع علامة (X) او كتابتها:

الوظيفة	الاطباء	الفنيين الصحيين	التمريض والقابلات	الاداريين	غير ذلك/ يرجى التحديد

4 - المؤهل العلمي:

المؤهل العلمي	دبلوم متوسط	دبلوم عالي	بكالوريوس	ماجستير او اعلى	غير ذلك/ يرجى التحديد

5 - يرجى تحديد مستوى اجادتك للغة الانجليزية بوضع علامة (X) في الجدول ادناه:

مستوي اجادة اللغة الانجليزية	لا اجيد اللغة الانجليزية	متوسط	جيد	متقدم

6 - مدى استخدام نظم المعلومات الصحية المحوسبة في المؤسسة:

	يرجى تحديد اجابتك بوضع علامة (X)	نعم	لا
1	يستخدم المستشفى نظامًا محوسبًا لتسجيل المعلومات الصحية للمريض		
2	يستخدم المستشفى نظامًا إلكترونيًا لإصدار الأوامر الطبية وطلب الفحوصات		
3	يستخدم المستشفى نظام محوسب لادخال نتائج الفحوصات وارسالها إلكترونياً		
4	يستخدم المستشفى نظام الاحالة الالكترونية للمرضى		
5	يتم الاعتماد على النظام الورقي بشكل كامل		
6	او أي تطبيقات الكترونية اخرى يرجى تحديدها:		

7- توقعك الشخصي حول مدى سهولة استخدام نظام السجلات الصحية الإلكترونية (EHRs).

يرجى تحديد اجابتك بوضع علامة (X):

	الفنية	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
1	أتوقع أن يكون التعامل مع نظام السجلات الصحية الإلكترونية واضحًا ومفهومًا					
2	أتوقع أن أجد النظام مرناً أثناء الاستخدام أي يمكن التعديل والاضافة والتصحيح عند حدوث اي خطأ					
3	أتوقع تعلم استخدام السجلات الصحية الإلكترونية لن يكون معقدًا					
4	أتوقع أن استخدام السجلات الصحية الإلكترونية أسهل من السجلات الورقية وأسرع من حيث الوصول والاسترجاع					

8 - توقعك الشخصي حول المنافع المتوقعة من استخدام السجلات الصحية الإلكترونية (EHRs)

	الفئة	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
1	أتوقع استخدام النظام سيمكنني من إنجاز المهام بسرعة أكبر					
2	أتوقع أن يؤدي استخدام النظام إلى تحسين أدائي في وظيفتي					
3	ان ميزة تبادل المعلومات الصحية الكترونيا بين مختلف المؤسسات الصحية التي تعتمد هذا النظام سيؤدي الى تحسين مستوى الخدمات الصحية بها					
4	أتوقع أن يدعم النظام القرارات السريرية حيث يمكن للطبيب الوصول بسهولة إلى التاريخ الطبي للمريض					
5	أتوقع أن يؤدي استخدام النظام إلى تنشيط الخدمات الإلكترونية بشكل كبير وخاصة الاستشارات الطبية					
6	أتوقع أن يؤدي استخدام النظام إلى تحسين سلامة المرضى وبالتالي تحسين مستوى الخدمات الصحية					
7	أتوقع أن استخدام النظام يساعد على تنظيم العمل و توفر الوقت والجهد والتكاليف					

9 - مدى توافر العوامل التي تساعد في تبني استخدام السجلات الصحية الإلكترونية:

	الفئة	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
1	تدعم البنية التحتية للمستشفى (الإنترنت، وأجهزة الكمبيوتر، وبرامج الأمان، والخوادم، وما إلى ذلك) استخدام السجلات الصحية الإلكترونية					
2	تدعم القوانين والتشريعات المتاحة استخدام التطبيقات الإلكترونية مثل السجلات الصحية الإلكترونية					
3	يمكن الاعتماد على طاقم تقنية المعلومات بالمستشفى للتدريب والمتابعة وحل المشاكل الفنية التي قد تواجه النظام مستقبلا					
4	تشجع الإدارة العليا بالمستشفى الموظفين على استخدام مثل هذه التطبيقات من خلال التعريف بها والتدريب عليها					
5	هناك توجه من وزارة الصحة للتشجيع على استخدام مثل هذه التطبيقات في المستشفيات					

10- التأثير الاجتماعي

الفئة	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
1 تشجع الإدارة العليا بالمستشفى الموظفين على استخدام مثل هذه التطبيقات من خلال التعريف بها والتدريب عليها					
2 هناك توجه من وزارة الصحة للتشجيع على استخدام مثل هذه التطبيقات في المستشفيات					
3 زملاء العمل يشجعون على استخدام تكنولوجيا المعلومات الصحية					

11 - إدراكك الشخصي لحالة القلق المرتبطة باستخدام النظام

الفنية	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
1 أن استخدام نظام السجلات الصحية الإلكتروني قد يكون معقدًا					
2 أعتقد أنني قد أفقد الكثير من المعلومات عن طريق الضغط على الزر الخطأ					
3 لا أحب استخدام أي وسيلة إلكترونية لأداء عملي					
4 يعد إدخال بيانات تشخيص المريض أو أي معلومات مرتبطة بعملي أمرًا معقدًا ويستغرق وقتًا طويلاً					
5 أنا قلق بشأن احتمال مواجهة مشكلة قانونية بسبب فقدان أو تسرب المعلومات من النظام					

12 - مدى رغبتك في استخدام نظام السجلات الصحية الإلكتروني (EHR) في حال استخدامه في المؤسسة:

الفنية	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
1 أتوقع ان استخدام النظام إذا تم توفيره في المؤسسة					
2 أتوقع استخدام النظام لتحسين جودة خدمات الرعاية الصحية					
3 أتوقع أن أتعاون مع زملائي من أجل الاستخدام الناجح للنظام وتحسين خدمات الرعاية الصحية لدينا					
4 أتوقع استخدام النظام إذا كان سيحسن أدائي					

5	أتوقع المشاركة في تصميم وتنفيذ هذا النظام				
6	إنها لفكرة جيدة أن أقوم بعملي أو جزء منه من خلال السجلات الصحية الإلكترونية				

مهارات الحاسب الآلي والرغبة في التدريب: يرجى تحديد اجابتك بوضع علامة (X).

13- كيف نقيم قدرتك على استخدام البرامج الاولى للحاسوب مثل تطبيقات الأوفيس (الورد والاكسل ...الخ) واستخدام الملحقات مثل الطباعة والمساحة الضوئية وغيرها؟

القدرة على استخدام الحاسوب	لا اجيد استخدام الحاسوب نهائيا	مبتدئي	متوسط	جيد	ممتاز

14 - يرجى تحديد فترة استخدامك لجهاز الحاسوب سواء في العمل او خارج العمل؟

استخدام الحاسوب	بشكل يومي	اسبوعيا	شهريا	لا استخدم الحاسوب نهائيا	غير ذلك/ يرجى التحديد

15 - هل ترغب في الحصول على دورة تدريبية على الحاسب الآلي لتطوير مهاراتك أو اكتساب مهارات جديدة؟

نعم، لدي الرغبة	لا، ليس لدي رغبة	لا، ليس لدي وقت	لا احتاج اليها، لدي مهارات كافية	غير ذلك/ يرجى التحديد

مدى معرفتك بالسجلات الصحية الإلكترونية والرغبة في التدريب عليها:

16 - هل لديك معرفة سابقة بماهية السجلات الصحية الإلكترونية وأهميتها والفرص التي قد تحققها؟

نعم، لدي معلومات عنها	
لا، ليس لدي معلومات عنها	

إذا كانت الإجابة نعم يرجى تحديد مصدر معرفتك في الجدول ادناه:

قراءة كتاب	مجلة علمية	من الانترنت	حاضرة مؤتمر علمي او ندوة حول (EHRs)	غير ذلك / يرجى التحديد

17 - هل سبق لك أن استخدمت أو تدريب على استخدام السجلات الصحية الإلكترونية (EHR) أو أي تطبيق صحي إلكتروني آخر؟

نعم	
لا	

إذا كانت الإجابة نعم يرجى استكمال الجدول:

اسم التطبيق أو السجل الإلكتروني الذي استخدمته أو تدريب عليه	يرجى تحديد نوع المعرفة: خبرة عملية أو دورة تدريبية أو غير ذلك	الفترة الزمنية مدة التدريب أو الخبرة العملية أو
إذا كان لديك أي إضافة أو تعليق حول هذه النقطة:		

18 - هل ترغب في الحصول على دورة تدريبية حول السجلات الصحية الإلكترونية للتعرف على وظائفها وفوائدها وكيفية استخدامها أو تطوير مهاراتك؟

نعم، لدي الرغبة	لا، ليس لدي رغبة	لا، ليس لدي وقت	لا احتاج إليها، لدي مهارات كافية	غير ذلك/ يرجى التحديد

التعليقات والتوصيات

إذا كان لديك أي تعليق أو إضافة يرجى كتابتها ادناه:

.....

.....

.....

.....

.....

.....

Appendix M: Letter of Interview Invitation

Dear-----

date-----

My name is Emad Elfituri, and I am conducting a PhD study from the University of Ottawa, Canada, under the title: Exploring Opportunities and Challenges of E-health adoption in Libya.

You have been invited to participate in this research interview because you have experience in the field of health work for at least eight years, as a doctor, nurse, health professional, or administrator.

The research aims to gather knowledge that would help lay down a strategy to implement electronic health records in the Libyan health institutions, as this technology is one of the most important electronic health applications that would improve the quality of the health services. This interview represents one of the important aspects of the research to identify the factors that affect the adoption and use of these records in Libyan health institutions.

In my estimation it ought to take about 20-30 minutes to interview. If you agree to volunteer, you will be asked to sign a consent form before the interview begins. As the audio recording of the interview is optional.

Participation is completely voluntary, and you may withdraw from the study at any time. The study is completely anonymous, and that all answers will be treated with complete confidentiality and will only be used for scientific research purposes.

We thank you for your cooperation and confirm that your answers have an important impact on the accuracy of the results and the achievement of the research aims.

Should you need anything at all clarified, please feel free to send me an email at: -----
or WhatsApp/ Viber: ----- phone# -----

If you accept our invitation, please contact the researcher directly. Note that the interview will be within the institution.

Yours sincerely,
Emad Elfituri

Appendix N: Consent Form (interview)

Dear respondent,

My name is Emad Elfituri, and I am conducting a PhD study from the University of Ottawa, Canada, under the supervision of Dr. Rocci Luppicini, titled: Exploring Opportunities and Challenges of E-health adoption in Libya.

Purpose: The purpose of this research is to gather knowledge that would help lay down a strategy to implement electronic health records in the Libyan health institutions, as this technology is one of the most important electronic health applications that would improving the quality of the health services.

Invitation to Participate: I invite you to participate in this interview, which represents one of the important aspects of the research to identify the factors that affect the adoption and use of these records in Libyan health institutions.

Procedure: Those agreeing to participate in the interview expect the following to happen. After the consent form has been signed, the researcher has a set of pre-prepared questions related to the research that will be presented in order. The interview takes around 20-30 minutes. As the audio recording of the interview is optional.

Risks: The researcher has assured the participant that there are no known risks involved in participating in this study.

Benefits: In participating in this study, the participant will not only be aiding the researcher in exploring opportunities and challenges of EHRs adoption in the Libyan health institution, but also in furthering the understanding of e-health solutions and its impact within healthcare settings.

Conservation of data: The data collected by using a tape recorder and notes by the researcher will be kept in a secure manner. The data will be kept for five years and only the researcher and supervisor will have access to it in this time. At the end of five years the tapes will be destroyed.

Confidentiality: All data produced from the study will be stored securely. Only the researcher and supervisor will have access to the data, which includes the tape recordings, transcripts, and any written notes by the researcher. The audiotapes of the interview will not contain any personal identifiers that could be linked to the participant.

- Any information that may identify participants such as job titles and/ or positions will not be disclosed in the publications.

- The research will refer to the specializations that participated in general (e.g., doctors, nurses, health technicians, administrators, etc.).
- The names of the hospital will be revealed in publications (Only if the hospital approval is obtained).

Voluntary Participation: It is your choice to take part in the study. There will be no penalty if you choose to not participate or to stop participation at any time during the research project. If you wish to withdraw from participating, it will be your decision if you would like the data collected from interviews up to that point can be used in the study. You can chose how involved you would like to be, and you do not have to answer any questions you do not feel comfortable in answering.

Acceptance: I, (participant's name printed) _____ agree to participate in the research study listed above conducted by Emad Elfituri of the university of Ottawa, which is under the supervision of Tom Rocci Luppicini.

If there are any questions about the study, the participant may contact the researcher or his supervisor. There are two copies of this consent form, one of which is for the participant to keep.

Audio recording of the interview is optional ☐ I agree ☐ I disagree.

Signature of the Participant: _____ Date: _____

Signature of the Researcher: _____ Date: _____

Contact Information

613-562-5387 and room 154.

Research Ethics Board (University of Ottawa):

If you have any questions regarding the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 154 Cumberland Street, Room 159, Ottawa, ON. K1N-6N5, Canada.

Tel.: 613-562-5387; Email: ethics@uottawa.ca

Researcher: Emad Elfituri: Email: -----

Telephone: ----- or WhatsApp/ Viber: -----

Supervisor: Rocci Luppicini: Email: -----

University of Ottawa, Canada: Telephone: -----

Appendix O: Consent Form (interview) in Arabic

نموذج موافقة على اجراء مقابلة بحثية

عزيزي المشارك،

بعد التحية:

تعد هذه المقابلة جزء من بحث علمي بعنوان:

استكشاف الفرص والتحديات لتبني الصحة الإلكترونية في ليبيا

Exploring Opportunities and Challenges of E-health adoption in Libya

Researcher name: Emad Elfituri
Supervisor name: Rocci Luppicini
University of Ottawa – Canada

اسم الباحث: عماد الهادي الفيتوري
اسم المشرف: روكي لوبيتشيني
جامعة أوتاوا – كندا

الغرض من البحث: جمع المعرفة التي من شأنها أن تساعد في وضع استراتيجية لتنفيذ السجلات الصحية الإلكترونية في المؤسسات الصحية الليبية، حيث تعد هذه التقنية من أهم تطبيقات الصحة الإلكترونية التي من شأنها تحسين جودة الخدمات الصحية.

دعوة للمشاركة: أدعوكم للمشاركة في هذه المقابلة التي تمثل أحد الجوانب المهمة للبحث للتعرف على العوامل التي تؤثر على اعتماد واستخدام هذه السجلات في المؤسسات الصحية الليبية.

الإجراءات: أولئك الذين وافقوا على المشاركة في هذه المقابلة يتوقعون حدوث ما يلي. بعد التوقيع على نموذج الموافقة، يكون لدى الباحث مجموعة من الأسئلة المعدة مسبقاً المتعلقة بالبحث والتي سيتم تقديمها بالترتيب. تستغرق المقابلة حوالي 20-30 دقيقة. حيث إن التسجيل الصوتي للمقابلة اختياري.

المخاطر المتوقعة: يؤكد الباحث للمشاركة أنه لا توجد أي مخاطره متوقعة تتعلق بالمشاركة في هذه الدراسة.

الفوائد: هي فرصة لتبادل المعارف والخبرات والتصورات مما يعطي المشارك فكرة أكبر على تطبيقات الصحة الإلكترونية وفوائدها في تحسين مستوى الخدمات الصحية. كما أنه من خلال مشاركتك ستساهم أيضاً في توفير معلومات تساعد على وضع إستراتيجية لتبني السجلات الصحية الإلكترونية في المؤسسات الصحية الليبية من أجل تطوير وتحسين مستوى الخدمات الصحية بها.

حفظ البيانات: سيتم حفظ جميع البيانات التي يتم جمعها بطريقة آمنة. كما أنه سيتم الاحتفاظ بها لمدة خمس سنوات وسيتمكن الباحث والمشرف فقط من الوصول إليها في هذا الوقت. في نهاية الخمس سنوات سيتم التخلص من هذه البيانات بطريقة آمنة.

السرية: سيتم تخزين جميع البيانات الناتجة عن الدراسة بشكل آمن. وسيتمكن الباحث والمشرف فقط من الوصول إلى هذه البيانات، والتي تشمل التسجيلات الصوتية، والنصوص، وأي ملاحظات مكتوبة من قبل الباحث. وسيتم استخدام هذه المعلومات في تحليل البيانات وكتابة الدراسة ولن تحتوي التسجيلات الصوتية للمقابلة على أي معرّفات شخصية يمكن ربطها بالمشارك. كما أنه لن يتم الكشف عن أي معلومات قد تحدد هوية المشاركين مثل المسميات الوظيفية و / أو المناصب في المنشورات. حيث سيشير البحث إلى التخصصات التي شاركت في الدراسة بشكل عام (مثل الأطباء والممرض وفنيي الصحة والإداريين ... إلخ). كما أنه سيتم الكشف عن أسم المستشفى أو المؤسسة الصحية في المطبوعات (فقط في حالة الحصول على موافقتها). كما سيتم استخدام علامات الاقتباس المجهولة في نشر النتائج.

المشاركة الطوعية: إن تطوعك لإجراء هذه المقابلة اختياري ولن تكون هناك أي عواقب إذا اخترت عدم المشاركة أو إيقاف مشاركتك في أي وقت أثناء مشروع البحث. عند الانسحاب من المشاركة، فسيكون قرارك ما إذا كنت ترغب في استخدام البيانات التي تم جمعها من المقابلة حتى تلك النقطة في الدراسة، كما أنك لست مضطراً للإجابة على أي أسئلة لا تشعر بالراحة في الإجابة عليها.

القبول: أنا (كتابة اسم المشارك)أوافق على المشاركة في الدراسة البحثية المذكورة أعلاه التي يجريها الباحث عماد الهادي الفيتوري من جامعة أوتاوا، والتي تخضع لإشراف روكي لوبيتشيني.

هناك نسختان من نموذج الموافقة، أحدهما للمشارك.

التسجيل الصوتي للمقابلة اختياري: ☐ أوافق على التسجيل ☐ غير موافق على التسجيل

توقيع المشارك: التاريخ:

توقيع الباحث: التاريخ:

هذه الدراسة قد تمت مراجعتها والموافقة عليها من قبل مكتب أخلاقيات البحث بجامعة أوتاوا. إذا كان لديك أي مخاوف أو استفسارات تتعلق بأخلاقيات البحث العلمي حول هذه الدراسة يمكنك الاتصال بهذا المكتب من خلال إحدى الوسائل الموضحة أدناه:

Contact Information

Research Ethics Board (University of Ottawa):

If you have any questions regarding the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, Cumberland Street, Room 159, Ottawa, ON. K1N-6N5, Canada.

Tel.: 613-562-5387; Email: ethics@uottawa.ca

إذا كان لديك أي أسئلة أو استفسارات يمكنك الاتصال بالباحث أو المشرف من خلال إحدى الوسائل الموضحة أدناه:

Researcher: Emad Elfituri: Email: -----

Telephone: ----- or WhatsApp/ Viber: -----

Supervisor: Tom Rocci Luppigini: Email: rluppici@uottawa.ca

University of Ottawa, Canada: Telephone: 001 613-562-5800 ext. 2510

Appendix P: The interview questions' guide

This is a general guide to interview questions, which expand and become more in-depth according to the participant's specialization.

1- What is the nature of your work in this institution?

2 - Do you have prior knowledge about electronic health and its applications, especially electronic health records? Could you please clarify?

3- Does your medical institution use any electronic applications? Such as-

These could be electronic patient records, electronic health records, electronic health prescriptions, telemedicine, or something else entirely.

4- What is the system currently used to manage patients' files? What are the main problems associated with this system?

5- Do you think the use of electronic health records will contribute to improving the health services in your institutions?

6- In your perspective, how might e-health applications facilitate daily work, and what are the problems that can be resolved using these applications?

The technological infrastructure:

7- In your opinion, is the hospital's technological infrastructure sufficient or reliable to implement electronic health records or any of the other electronic applications?

- How do you rate its readiness?
- Does the technology infrastructure meet the staff's tasks and needs?
- What are its most pressing issues?
- How can it be improved?

Legislation and Policies:

8- Are the available legislation and policies compatible with the work of electronic applications, or should they be updated? please clarify.

9- Are there ethical concerns or issues that may arise as a result of the use of electronic health records in health institutions?

Skills (acceptance and operation of electronic health records)

10- Is there awareness among workers in general about electronic health records and their importance?

(Is it a commonly used and well-known term, or is it rare?)

11- How would you feel if you were given the opportunity to train or develop your skills in using the computer and one of the electronic health applications that would help you in doing your work?

12- Are there other factors that may help in the process of acceptance and use?

13- Is there interest and encouragement from the hospital administration towards the use of health information technology?

14- Is there a general trend from the Ministry of Health towards encouraging the use of electronic applications within health institutions? (In the sense of moving towards electronic transformation.).

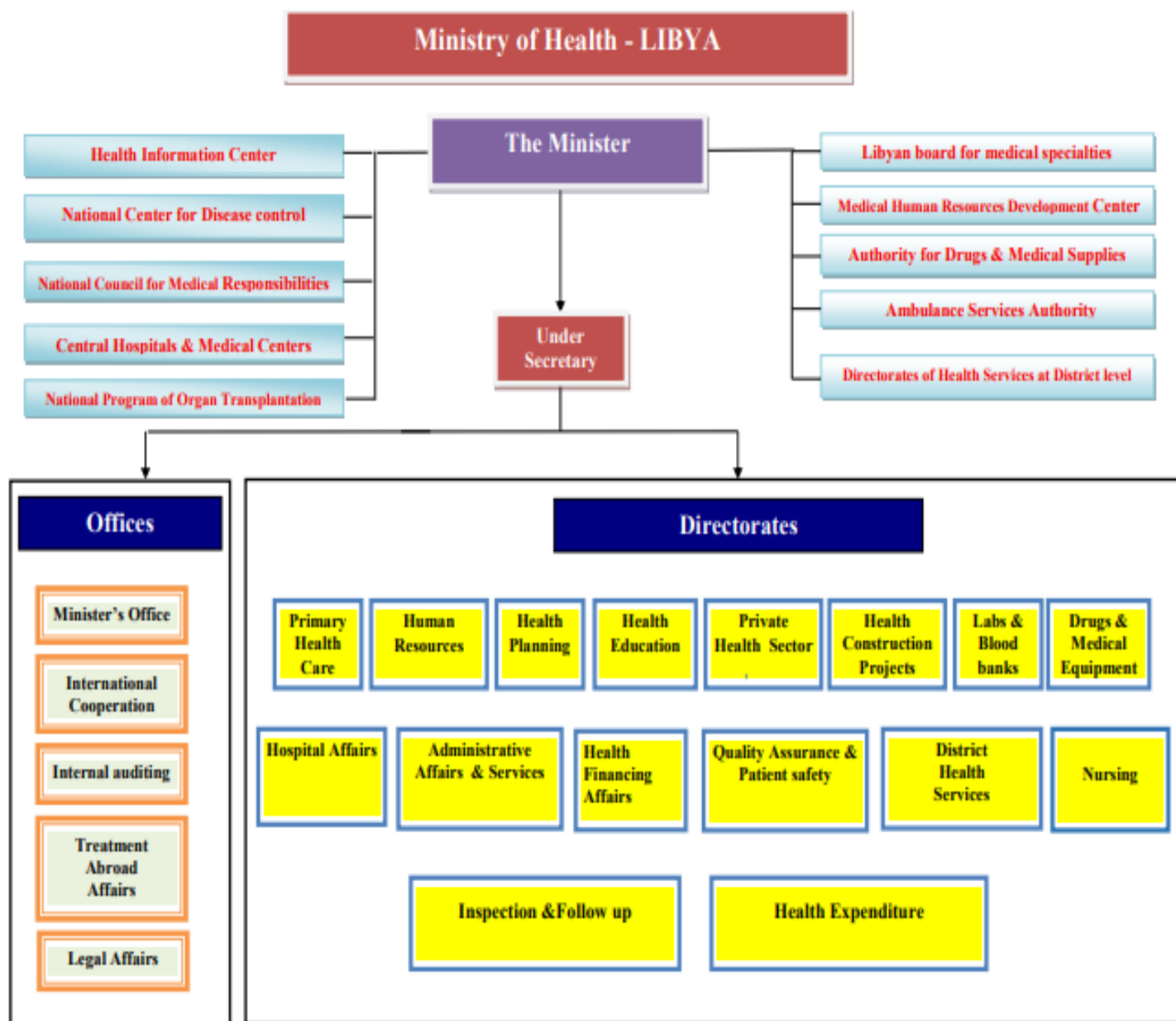
15- Do you think that funding will be one of the challenges that may face the implementation of this technology in Libyan hospitals? why?

16- Is the hospital facing financial difficulties in providing basic requirements?

17- How can hospitals overcome financial barriers?

18- Is there anything else you would like to add or something you feel you need to recommend or comment on?

Appendix Q: The structure of the Libyan Ministry of Health



Sours: World Health Organization (WHO), & Government of Libya. (2017).

Appendix R: The sample's descriptive statistics

The sample size, Skewness, and Kurtosis for the variables used in the regression model.

The variables	Mean	Std. Deviation	N	Skewness	Kurtosis
BI	3.6299	.56317	136	- 0.130	- 0.330
EE	3.5699	.71988	136	- 0.217	- 0.868
PE	3.7658	.60526	136	- 0.039	- 0.377
SI	2.8431	.53355	136	- 0.430	- 0.196
FC	3.019	.52977	136	0.170	0.823
ANX	3.201	.58485	136	- 0.017	- 0.553

Appendix S: The sample's awareness of e-health

Theoretical and practical knowledge of electronic health (awareness).

Job	Answer	Theoretical knowledge		E-health trained		Operating experience	
		Number	%	Number	%	Number	%
Physicians	No	22	35 %	44	83 %	47	75 %
	Yes	40	65 %	18	17 %	15	25 %
		62	100 %	62	100 %	62	100 %
Nurses	No	14	56 %	23	92 %	23	92 %
	Yes	11	44 %	2	8 %	2	8 %
		25	100 %	25	100 %	25	100 %
Administrative	No	8	36 %	20	90 %	21	95 %
	Yes	14	64 %	2	10 %	1	5 %
		22	100 %	22	100 %	22	100 %
Health professional	No	15	56 %	25	93 %	26	96 %
	Yes	12	44 %	2	7 %	1	4 %
		27	100 %	27	100 %	27	100 %

Appendix T: Document List

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Appendix U: Themes, Sub-Themes, and Example Quotes

Themes and Sub-Themes	Example Quotes	
Technological environments of hospitals		
Al-Khadra Hospital	The patient record only contained identifying information and residence registration data, leaving out medical information. Doctors, on the other hand, could access medical laboratory results and medical imaging from their respective departments. They only used the pharmacy record for medication dispensing and inventory management; they did not link it to other departments (Participant #11).	This constituted the first phase, with a second phase planned that was to include the entry of patients' medical files. However, the country's conditions and the resulting obstacles prevented the implementation of the second phase, resulting in a neglect of the progress made. Other hospitals could have applied the lessons learned from this experience, but the circumstances hindered the project's completion. (Participant #12).
Tripoli University Hospital	The network is partially working, and we are trying to benefit from it as much as possible; for example, this week, a live surgery was broadcast with high quality, and many trainees were able to attend it from the room designated for conferences, listening to the specialist's notes and directions (Participant #6).	In addition to the negative effects of this instability, such as resource waste, infrastructure neglect, and a lack of attention to training programs on modern technology and its use to keep pace with development, the Ministry of Health has not provided any direction or obligation for hospitals to adopt this technology. (Participant #8)
Tripoli Central Hospital	From my experience, hospital workers of all specialties welcome any training courses that help them perform their work, as the course is considered an advantage given to the employee. Unfortunately, there is currently no plan to develop workers' skills in using health information technology or invest in this field. Instead, all the focus is on maintaining hospital buildings and providing operating supplies and medical equipment (Participant #13).	Integrating the hospital's modern medical equipment in the laboratories, imaging center, outpatient departments, and clinics into an electronic record through the hospital's internal network would enhance its effectiveness (Participant #15).
National Heart Center	In 2005, the hospital attempted to implement an EHR system, initially entering medical data for patients. However, the system ceased functioning due to several issues, including technical malfunctions, negligence, and a lack of appreciation for its importance. The failure of this initiative highlights the critical need for proper planning, adequate resources, and continuous support.	The implementation of electronic medical records in the hospital was premature, meaning that the time was not appropriate. During that period, this term was not widely used, nor was information technology as prevalent as it is today, as exemplified by the proliferation of smartphones and other digital devices... (Participant #4).

The Challenges of Using Information Technology Technological infrastructure Skills Work culture and officials' interests Financial resources	The hospital lacks an integrated internal network for exchanging health information and facilitating work. An internal network would undoubtedly help connect various departments, easing daily operations. For instance, with a network, the radiology department and the medical analysis laboratory could link to other departments, allowing treating physicians to access results quickly and easily. (Participant #6) Al Khadra Hospital has only two IT specialists who manage all network and device maintenance, along with some data entry personnel in the documentation and information department (Participant #11). The hospital administration shows no interest in implementing new work practices, such as implementing an internal electronic system for internal correspondence. This would create an internal network that links all hospital departments, facilitating the rapid exchange of information and circulars. This approach would replace the traditional system and administrative bureaucracy. (Participant #6) Despite the intention to cover salary increases due to employment expansion, the budget increases overlooked the impact of external economic factors, specifically inflation. As a result, the budgets were insufficient to meet many of the hospitals' essential needs, and they were unable to meet their obligations (Participant #12).	... the equipment in the university hospital is considered good and meets the needs of current uses (such as patient admission records, administrative and financial affairs, and some departments), but it will not be sufficient if we adopt electronic health records (Participant #8). When electronic records were introduced in the Heart Hospital in 2008, new employees with skills in data entry and managing electronic medical records were hired. However, hiring new employees for these roles today is challenging due to the already large staff in hospitals (participant #2). The only letter from the Ministry of Health on this subject was several months ago asking hospital pharmacies to use an electronic application to link them to the medical supply to provide medicines, and no letter was attached to follow up, provide support, or otherwise (Participant #3). Why not set a reasonable fee for each patient? There is no doubt that this mixed system will help hospitals achieve a return that will help them pay incentives to doctors and provide necessary resources, thus improving their services and reducing the burden on the public treasury (Participant #10).
Opportunities to use information technology. Facilitate health information exchange and clinical decision support.	We often face critical situations in which the time factor is crucial, as the speed of the treating physician's access to the patient's file is crucial to knowing the health problems that the patient suffers from in order to help him diagnose his condition and determine the necessary steps to save his life. (Participant #8)	Through my study of e-health solutions and my practical experience in Libyan hospitals, I can leverage the decision-support tools offered by electronic health records. These tools provide evidence-based recommendations for diagnosis and treatment, assisting caregivers in making informed decisions about diagnosis and treatment protocols, thereby improving healthcare quality (Participant #11).

Schedule appointments and reduce waiting time in hospitals.	There is no doubt that using such applications will greatly help us in managing time and arranging appointments, and they do not require special skills to deal with, as we see them widely used in many other service activities today. Unfortunately, hospital administrations have shown no interest in these tools (Participant #3).	We hope that hospitals will adopt electronic health records, but at the present time it would be beneficial if hospital administrations adopted some electronic applications that help us in our daily work, such as applications for scheduling appointments, medical tests, and internal correspondence. Such applications will pave the way for future reliance on e-health solutions. (Participant #16)
Efficiency and speed of access in managing patient files.	One of the challenges we face is providing spaces to store patient files. We are unable to store them in remote locations due to the increased time required for patient file retrieval and the risk of loss or damage. Additionally, human error, which sometimes occurs when a file is returned to the incorrect location, can make future access difficult and time-consuming, a problem that electronic systems can eliminate.	In the traditional paper system, once a person has access to the archives and records, he can access all the files, while access to the electronic record requires permits, access powers, a patient number, and other security precautions (Participant #16).
Reducing medical errors	The Arabic language in Libya is the official language, while the English language is the accepted language in the medical community, as patient diagnoses, medical reports, prescriptions, test results, etc. are all in the English language. As a result, some people struggle to read prescriptions or reports written by certain doctors because of their varying language skills and the similarity of numerous medical terms, which can lead to mistakes. However, we can prevent these errors by employing electronic systems (Participant #14).	The presence of this application in the hospital will help doctors overcome several difficulties and avoid some medication errors, such as alerting the doctor to possible drug interactions or contraindications for use and providing admission screening tools that identify patients at risk of rejection after organ transplantation, which will enhance the capabilities of doctors and improve the quality of health care for patients (Participant #16).
E-referral advantages	The activation of the referral system is beneficial. Currently, we are grappling with the issue of open access, where many patients receive direct care without going through primary health care centers, a practice that violates applicable regulations. However, the adoption of electronic referral will eradicate this issue, thereby reducing the patient count and waiting time (Participant #9).	 implementing electronic referrals can enhance coordination between hospitals during the patient reception and acceptance process (Participant #8).