UNIVERSITY OF TURKISH AERONAUTICAL ASSOCIATION
INSTITUTE OF SCIENCE AND TECHNOLOGY

UNIFIED ELECTRONIC MEDICAL RECORD IN LIBYA

MASTER THESIS

AOSAMA M.S HMODHA

DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAM OF INFORMATION TECHNOLOGY

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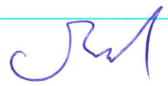
I hereby declare that all information in this study I presented as my Master's Thesis, called: "Unified Electronic Medical Record in Libya", has been presented in accordance with the academic rules and ethical conduct. I also declare and certify with my honor that I have fully cited and referenced all the sources I made use of in this present study.

11.01.2018

Aosama M.S HMODHA



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January 2018 Aosama M.S HMODHA

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LIST OF ABBREVIATIONS

AHR	**:**	Automated Health Record
CPR	**:**	Computed-based Patient Record
DSL	**:**	Digital Subscriber Lines
EHR	**:**	Electronic Health Record
EMR	**:**	Electronic Medical Record
ICT	**:**	Information and Communication Technology
IT	**:**	Information Technology
UEMR	**:**	Unified Electronic Medical Record
WHO	**:**	World Health Organization

ABSTRACT

UNIFIED ELECTRONIC MEDICAL RECORD IN LIBYA

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The concept of Unified Electronic Medical Record (UEMR) aims mainly to maintain patient's information at every visit in an electronic form for future reference, which can assist physicians perform diagnosis and treatment based on an informed history. Moreover, UEMR provides the necessary data for healthcare management to develop short and long-term planning, and strategies for healthcare services. In this research, the concept of UEMR is researched for acceptability and implementation for the Libyan healthcare institutions. The UEMR include clinical information, such as medical images and diagnosis texts. Several health record concepts are reviewed, along with the advantages and disadvantages of the system. Increasing productivity, facilitating reporting and increasing patient's satisfaction are among the benefits of using UEMR, while increasing operation costs, medical errors and training requirement are considered part of the disadvantages that accompany UEMR. The case study measures the acceptance of the professionals in Libyan healthcare institutions towards UEMR through the behavioural intention model, which contains four elements; perceived usefulness, perceived threat, perceived ease of use, and social influence. Twenty-eight indicators are identified from the literature through a questionnaire taken by 188 participants. The results show an acceptance rate of 75.61% among the participants for UEMR, indicating good acceptability of the concept. Furthermore, a UEMR prototype is designed for Libya incorporating different clinical and administrative functions that are required for the system. The study provides conclusions and recommendations for UEMR development and implementation in Libya.

Keywords: Unified Electronic Medical Record (UEMR), behavioral intention, prototype, Libya

ÖZET

LİBYA'DA BİRLEŞTİRİLMİŞ ELEKTRONİK TIBBİ KAYIT

Hmodha, Aosama M.S
Yüksek Lisans, Bilgi Teknolojileri Bölümü
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Birleşik Elektronik Tıbbi Kayıt (UEMR) kavramı, hekimlerin bilgilendirilmiş bir geçmişi temel alarak teşhis ve tedavide yardımcı olabilmesi için gelecekteki başvurular için elektronik olarak her ziyarette hasta bilgilerini tutmayı amaçlamaktadır. Üstelik, UEMR sağlık yönetimi hizmetleri için kısa ve uzun vadeli planlama ve sağlık hizmetleri stratejileri geliştirmek için gerekli verileri sağlar. Bu araştırmada, UEMR kavramı, Libya sağlık kurumlarının kabul edilebilirliği ve uygulanması için araştırılmıştır. UEMR, tıbbi görüntüler ve tanı metinleri gibi klinik bilgileri ve kayıt. Sistemin avantajları ve dezavantajları ile birlikte çeşitli sağlık kaydı kavramları gözden geçirilmektedir. UEMR'yi kullanmanın faydaları arasında verimliliği artırmak, raporlamayı kolaylaştırmak ve hastanın memnuniyetini artırmak da yer alırken, operasyon masraflarını artırmak, tıbbi hatalar ve eğitim gereksinimi UEMR'e eşlik eden dezavantajların bir parçası olarak düşünülmektedir. Vaka incelemesi, dört unsuru içeren davranış niyeti modeli aracılığıyla Libya sağlık kurumlarındaki profesyonellerin UEMR'ye kabulünü ölçmektedir; algılanan yararlılık, algılanan tehdit, algılanan kullanım kolaylığı ve sosyal etki. Literatürde, 188 katılımcı tarafından alınan bir anket aracılığıyla 28 gösterge belirlenmiştir. Sonuçlar, konseptin kabul edilebilirliğini gösteren UEMR katılımcıları arasında 75.61% kabul oranı göstermektedir. Ayrıca, Libya için sistem için gerekli olan farklı klinik ve idari fonksiyonları içeren bir UEMR prototipi tasarlanmıştır. Çalışma, UEMR'nin Libya'da geliştirilmesi ve uygulanması için sonuç ve tavsiyeler sunmaktadır.

Anahtar Kelimeler: Birleşik Elektronik Tıbbi Kayıt (UEMR), davranışsal niyet, prototip, Libya

CHAPTER ONE

INTRODUCTION

1.1 Overview

Unified Electronic Medical Records (UEMR) represent combined pools of medical information about personal health and health care from cradle to grave. UEMR contain information about patients' encounter with all levels of healthcare from primary to tertiary care levels. UEMR is able to gather, store, and retrieve patients' data electronically and supply that information to physicians and other healthcare providers as needed. A well designed UEMR system is essential for building robust and effective health systems that can provide comprehensive and integrated health care and at the same time provide real time and comprehensive information for public health policies and financing decision makers.

In developing countries, including Libya, the health care provision and management is highly ineffective and the progression toward the application of UEMR in various patient care settings is under-prioritized [1]. Despite being reach in natural resources and having low population, Libya is yet to benefit from the value of UEMR to improve the healthcare system. Developing strategies to build effective UEMR system requires understanding of the current state of readiness in the healthcare system to adopt such technologies, barriers and facilitators at the individual, organizational and community levels. It's also important to illustrate the potential benefits of applying such a system to the Libyan healthcare structure on the economic, social, medical and other dimensions important to healthcare decision makers.

The first phase of this work involves a review of previous research is conducted to provide evidence of the evolving needs of better healthcare record management in Libya and the potential benefits, barriers and facilitators of its application. In the second phase of this work, the researcher conducts an exploratory research to

investigate the availability of infrastructure for the application of UEMR technology in the Libyan healthcare system and readiness and acceptability of health workers in Libya to adopt such technology. Finally, a complete UMER system is proposed tailored to suit the application in Libyan healthcare system based on information collected in the first two phases of this research.

The results of this work form a solid basis for developing a comprehensive strategy for application of a unified UEMR system in the Libyan healthcare system. In this way, Libyan health care policy decision makers will have a good opportunity and solid ground information to make changes to the healthcare system that improves the overall quality of healthcare delivered to the Libyan tax payer.

1.2 Thesis Aim and Objectives

The aim of the study is to form a firm foundation that helps Libyan healthcare decision makers to develop the best strategies for adopting and implementing a UEMR system in health institution throughout the country. To achieve this goal, an explorative literature review is conducted to identify the current body knowledge about the UEMR application globally and the evidences regarding the evolving needs to better healthcare record management in Libya. The review highlights the potential benefits, barriers and facilitators of UEMR application in developing countries in general and in Libya specifically. Therefore, the objectives of the research are as the following:

1. Understand the definition of UEMR and its basic functionalities.
2. Review case studies that involve researching, maintaining or implementing UEMR around the world.
3. Study the benefits and the pitfalls of adopting UEMR in healthcare institutions and on the national level.
4. Review the literature for the acceptance of UEMR socially and professionally.
5. Study the social, professional and technical challenges that would face developing, implementing and maintaining UEMR.
6. Conduct a subjective assessment on implementing UEMR in Libyan healthcare institutions using a questionnaire method.
7. Evaluate the acceptance of UEMR amongst the physicians, medical staff, and healthcare management professionals.

8. Develop a prototype UEMR that includes the lessons learnt from previously developed models.
9. Provide recommendation to Ministry of Health at the State of Libya for UEMR development, implementation and maintenance.

1.3 Methodology Summary and Thesis Structure

The current study involves an exploratory research part in which the availability of infrastructure required for UEMR application is examined together with the readiness and acceptability of the health workers in Libya to adopt such technologies. This is accomplished through a structured formal experience survey with all stockholders of the system from physicians to the patients.

Based on all of the information gathered through both the exploratory and explanatory part of the research, an integrated system for managing and administering the UMER in the Libyan healthcare system is proposed. Such system would serve as prototype to be tested and validated for the real-life application.

This thesis consists of six chapters excluding the references and the appendices. The first (current) chapter comprises a brief introduction to the thesis together with an outline of the thesis organization. The second chapter represents the first phase of this study (literature review) and comprises a review of prior literature relevant to research questions introduced in the first chapter. The third chapter is composed of description of the methodology and of the exploratory research part of this thesis. This is followed by the fourth chapter which narrates the findings of the questionnaire on the acceptance of UEMR in Libya, and fifth chapter which outlines the implementation details for a UMER system designed specifically for the Libyan context. Thereafter, the discussion of the findings, conclusions and recommendations are presented in the sixth chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1 UEMR Definition, Function and Users

According to the World Health Organization (WHO), there are four different types of electronic health records, which are [2]:

1. Automated Health Records (AHR): refers to collecting health record images and storing them into an optical disk for further reference, which is a process that started in the last decade of the twentieth century. However, these records were for the purpose of storing rather than keeping a live record that accepts input and output upon patient visits.
2. Electronic Medical Record (EMR): refers to a health record with an automated process and systems which are developed within a domestic healthcare community. The system allows the different members of the healthcare community such as physicians, radiology specialists, and lab personnel to update the health record of the patient each visit.
3. Computer-based Patient Record (CPR): refers to a record system that collects the data of the patient and can be updated by the different healthcare personnel. However, the use of this system is mainly used for inpatient departments.
4. Electronic Health Record (EHR): refers to a system that includes all patient's data and information including a health profile, behaviors and environment. The EHR provides the record with timing, which could serve as a lifetime record.

Although all types of medical records seem different depending on the interaction functionality, type of medical information and practicality, all types are considered adequate for healthcare use. Nonetheless, Electronic Medical Records

(EMR) and Electronic Health Record (EHR) have similarities in their functionality and practicality, but differ by the type of information, which is only limited to physiological diagnosis and treatment in the EMR case [2].

Medical practitioners' daily routine work involves dealing with large amounts of data that is being continuously documented and communicated through medical records. Despite the wide spread of information and communication technology (ICT), the paper-based medical record keeping is still persistent. According to [3], less than a quarter of physician-based health institutions have adopted an UEMR system. The concept, history, and benefits of UEMR are researched in the following sections.

A medical record of a patient comprises all patient specific data including but not limited to patient's presenting symptoms, annotations from the physician and other treating healthcare professionals, subjective data from the patient, imaging reports, laboratory data, medication history and current medications. A medical record is essential sources of information for the patient's healthcare provider and as historical records for consultants and insurance companies and in litigation cases. Medical records also represent a cheap, and readily accessible source of information for retrospective research.

There was a significant evolution of the major focus of medical records. The first known medical record is credited to Hippocrates who recorded observations on patients in chronological order creating a time-ordered medical record [4]. The concept of patient-centered medical record was pioneered by physicians at Mayo clinic in 1907 by creating one separate file for each patient. SAOP notes, which was an innovative problem-oriented medical records, was introduced by Lawrence Weed, MD, in the 1960s for the purpose of standardizing patient records [5].

In spite of these improvements in patient data recording systems, all these paper-based systems had several limitations. They are difficult to be retrieved from one hospital department by another especially in large hospitals. In addition, they cannot be accessed simultaneously by more than one person in different places. Moreover, paper-based systems have limited storability because of the large space required for storage and susceptibility to damage by water or fire. When paper-based records are lost or damaged, no back-up is found, and resource intensive effort is required to reproduce the data which is possible only partly in best scenarios.

The users of UEMR are all healthcare personnel, management and clinical staff. However, the different levels of users may have different authorities in entering, editing and disposing the data from the system. For instance, the management positions could have authority to add, alter and delete information, while physicians can be the only users who are allowed prescribe drugs. Other personnel such as radiology and lab specialists can add information to the system according to their discipline including x-ray images, while pharmacists and nurses can add notes and raise alerts [6].

The functions that are implemented in the UEMR are divided into two main categories; clinical and administrative. Table 2.1 shows the different functions that can be performed under each category.

Table 2.1: Functionalities included in UEMR [7].

Clinical Functionalities	Administrative Functionalities
Writing diagnosis and patient's summary	Patient registration
Storing patient information	Billing and payment
Storing diagnosis digital imaging	Appointments
Issuing referral letters	Payroll
Issuing prescriptions	Medical stock records
Noting consultations	Healthcare institution finances
Consulting medical staff	Insurance claims
Medical reminder system	
Providing suggestions for diagnosis or treatment	

The workflow embedded in the UEMR system are very critical as it affects its functionality and influences the acceptance and satisfaction from the system. However, these workflows shall be based on the needs and requirements of the clinical and healthcare management teams. Figure 2.1 represents a workflow of an UEMR system within the healthcare institution.

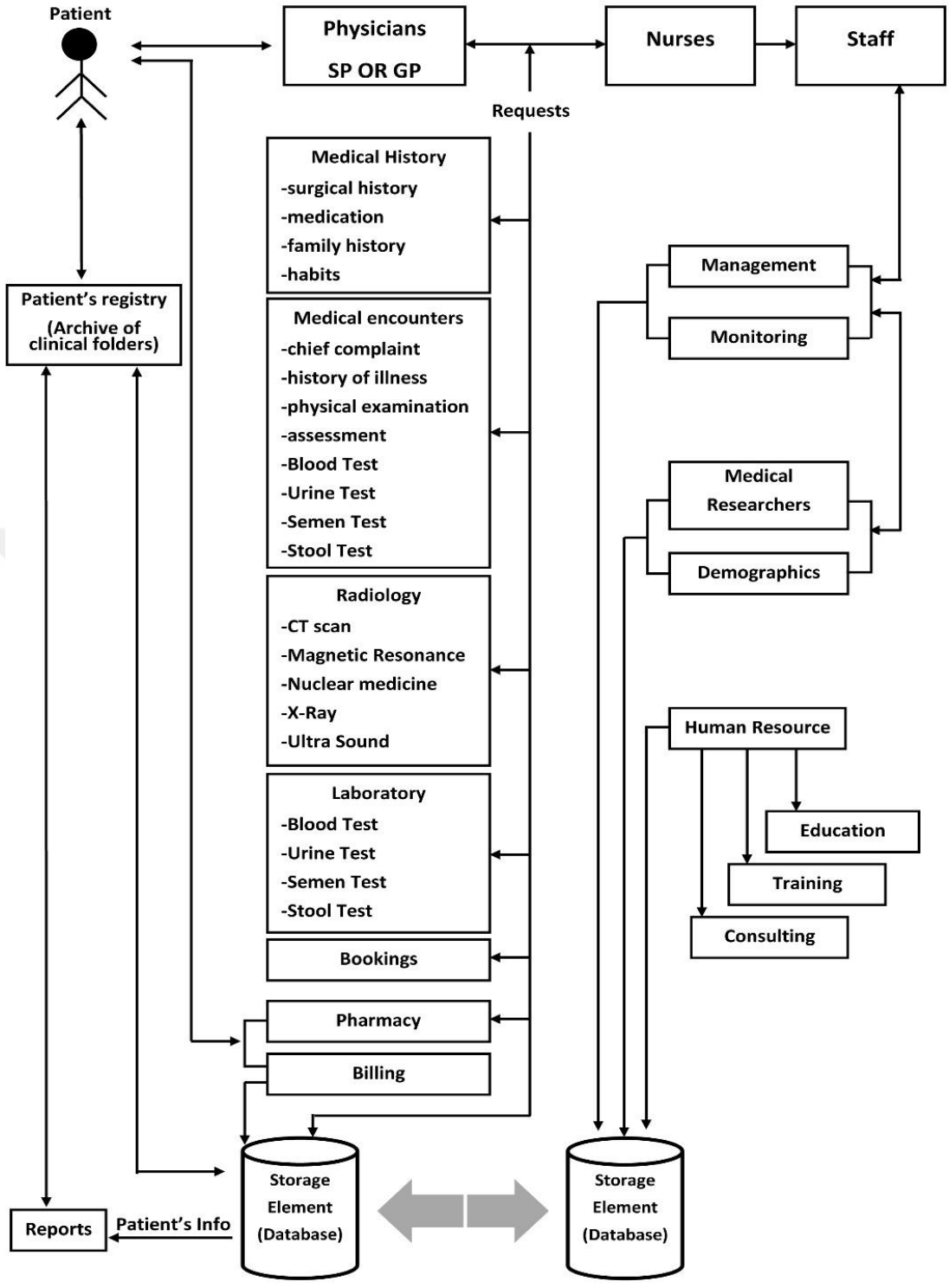

Figure 2.1: UEMR prototype workflow chart [8].

2.2 UEMR Benefits and Issues

UEMR systems can overcome all the disadvantages described above about the paper-based systems in addition to offering new opportunities. Data stored in an UEMR can be easily accessed from any site any time and simultaneously by any number of users. Huge amounts of data can be stored in very small storage media such as hard drives that now can store up to 5 Terabytes of data.

The availability of high speed internet connection through digital subscriber lines (DSL) and cable modems makes back-up and data retrieval from remote servers a feasible process. Additional features offered by computer based systems is the enhanced security where data can be accessed by authorized users only whom privileges can be controlled, and this access can be tracked and monitored for inappropriate activity. Some EMR systems provide additional information management tools that help physicians by supporting their clinical decisions by sending a reminder for a follow up laboratory test, for instance. The advantages of UEMR system implementation include [9]:

1. Allows proactivity in healthcare practices
2. If supplied with accurate records, the information can be double checked easier
3. Facilitate reporting activities
4. Increase patients' satisfaction
5. Empower clinical and management decision-making process

Nevertheless, UEMR systems do have some risks and disadvantages. The cost for initiating an UEMR system is high considering the price of infrastructure, software, and support in the form of training and technical problems troubleshooting. It requires that healthcare professional devote some of their time away from patients to learn how to operate the system and modify the work process. Another major disadvantage of implementing an UEMR is programmer or user errors, which may cause loss of data or unauthorized access to patient data. This is more likely to happen than one may imagine. For instance, a pharmaceutical company accidentally disclosed contact information for more than 600 patients who were subscribers for reminders regarding their medication [10]. Furthermore, the main weakness of UEMR systems are [9]:

1. High costs that could form a burden on the healthcare institution
2. Interoperability limitations

3. Increase of medical errors
4. Necessity of comprehensive trainings for all healthcare professionals
5. Can slow down physician and decrease productivity up to 20%
6. Vulnerability for security threats

2.3 Implementation Challenges

Despite the many benefits associated with implementing UEMR system in healthcare facilities, there are several issues that arise from its implementation from a quality and safety points of view. The first issue is potential improper use of the system, which means that it can be misused functionally, creating unwanted, duplicated or missed records that can results from [11]:

1. Technically challenging system design and complexity.
2. Designing the system without considering the type of knowledge that are available by the users.
3. Using a workflow system that confuses the users.
4. Having a type of information that cannot be changed in the system without a high-level authorization.

Another issue that could accompany implementing a UEMR is poor usability, which occur when the system does not have the flexibility to fit real-life clinical needs. In emergency departments some drugs may need to be ordered urgently. However, this order can be denied due to the absence of an authorized personnel that might not be available. On the contrary, the authorization of ordering the drug by unqualified personnel can cause safety issues [11].

The UEMR system can be challenging in maintaining the quality of the records through capturing documentation in an improper way. Healthcare personnel may tend to copy and paste information if rushing, which would cause issues in duplicate information, unidentified information author, false information, and inconsistent records [11].

Furthermore, technical challenges involve inadequate hardware, complex procedures and time consumption that may be resulting from using the system. These challenges are usually addressed by providing proper training courses and technical support that could help the staff to overcome them. Moreover, pairing experienced

with unexperienced staff could be a successful strategy to follow to overcome such issues [12].

The organizational environment can impose challenges on implementing the UEMR system in the healthcare facility. Depending on the authority of the different positions within the organization, some personnel may find distributing certain authorities to other personnel as a reduction of their power, especially management staff [6].

Other professional and technical challenges can involve the users of the system and their circumstances. In a study that surveyed the different types of challenges in implementing UEMR system, physicians have indicated that they are facing barriers regarding the following issues [13]:

1. Lack of computer skills
2. Lack of training
3. Lack of technical support
4. System's complexity
5. Lack of system reliability
6. Lack of technical hardware

With regard to the social challenges, a literature review has shown that the main social issues that faces physicians and healthcare professionals in implementing UEMR involve being not sure about the vendor providing the system and lack of support from other parties. Therefore, it can be understood that the healthcare professionals are worried that they would not receive the necessary support from the imposers of the system. Moreover, interference with doctor's relationships with the patients is another challenge feared by the physicians, as they may feel that implementing a UEMR could change the way they treat patients or pay attention to them [13].

Furthermore, in the Arab world countries, computer literacy form one of the challenging from the social perspective, as well as resistance to change. The language barriers is also present as the majority of the population do not speak English, which is the language such system would be provided in. From the healthcare professionals point view, they are also afraid that implementing UEMR would increase their work load [14].

Furthermore, financial challenges arise from implementing UEMR systems due to additional setting up and running costs. Since the Ministry of Health usually look at

such a system an investment, there is always a risk of not recovering the costs through return over investment [15].

2.4 Measuring Acceptance for UEMR for Implementation

Measuring the acceptance and readiness for an UEMR system can be critical as a new system that requires development, learning and adaption by the healthcare personnel. Therefore, measuring acceptance, adaptability and satisfaction is necessary prior the development and the implementation of the UEMR system. Moreover, a set of indicators shall be developed for the questionnaire design. Furthermore, there are six stages, Figure 2.2, that need to be fulfilled to develop UEMR, which are [16]:

1. Assessment: measuring the readiness and acceptance of the healthcare professionals towards using UEMR
2. Planning: Setting a financial and time plan for the UEMR system implementation
3. Selection: choosing the criteria and workflows that shall be included in the system
4. Implementation: Developing the system in accordance with the healthcare facility needs and requirement
5. Evaluation: measuring the satisfaction from using UEMR by the healthcare professionals, as well as evaluating the criteria and workflows that are included for efficiency and impact on productivity and experience
6. Improvement: rectifying the pitfalls of the system in accordance with work systems' needs

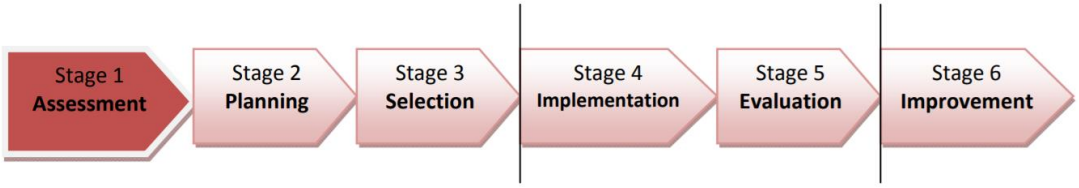

Figure 2.2: Development steps of UEMR [16].

Moreover, measuring the acceptance of implementing UEMR requires evaluating the perception of the physicians and the healthcare professionals of the value-added by the system implementation. Therefore, the model that is used to

measure the acceptance of the UEMR is called the behavioral intention measurement, which requires measuring four main dimensions, as shown in Figure 2.3 [17]:

1. Perceived usefulness
2. Perceived threat
3. Perceived ease of use
4. Social influence

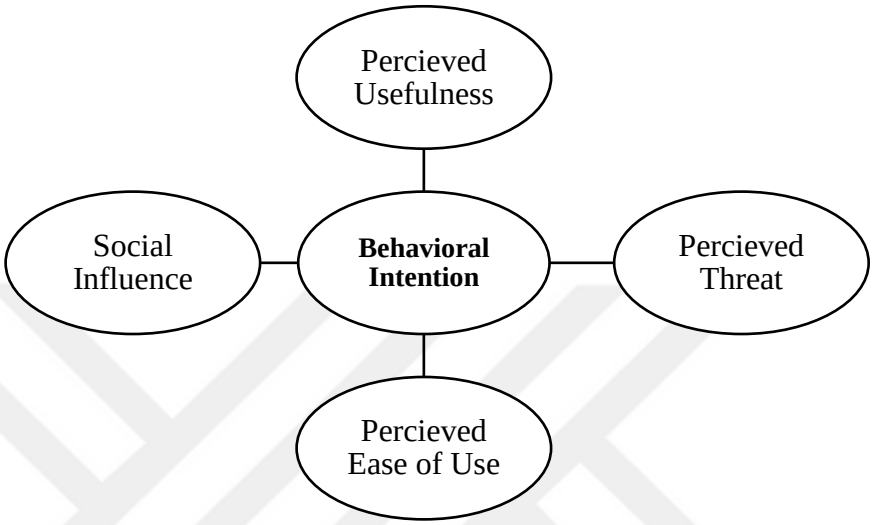

Figure 2.3: Measuring acceptance using behavioral intention [17].

In a study that measured the acceptance of UEMR the following perception, norm and change readiness dimensions were included, along with their indicators [18]:

1. Usefulness
   a. Allow quick access to patient's information
   b. Ease communication between healthcare professionals
   c. Avoid examination duplication
   d. Healthcare quality improvement
   e. Error risk reduction
2. Easiness
   a. Usage learning is time consuming
   b. Easy to use
   c. Simple to use
3. IT learning
   a. Willingness to use if training is provided
   b. Willingness to use if technical training is provided
4. UEMR impact

    a. Easing communication with others
    b. Imposing visible impacts
5. Individual factor
    a. Comfort with using technology
    b. Embracing change
    c. Adaptability to new things
6. Social acceptance
    a. Healthcare professional approval
    b. Physicians approval
    c. Patients approval
7. Professional acceptance
    a. Norm of physician using a UEMR
    b. Need for specialty of physician
8. Change resistance
    a. Rejecting UEMR
    b. Rejection in case it affects clinical decisions
    c. Rejection if daily practice and workload is changed

Furthermore, additional studies and indicators can be incorporated in measuring the acceptance towards implementing UEMR, which are reviewed in the questionnaire design section of the next chapter.

CHAPTER THREE

METHODOLOGY

3.1 Review Research

Review research is the critical analysis of a part of published scientific resources through summarizing, categorizing and contrasting prior studies, literature reviews, and/or theoretical articles. Such review of past scientific publication is integral part of any academic research. Literature review forms a solid basis for knowledge advancement through facilitation of theory development and identification of areas where research is required.

Based on the purpose of the review, there are three types of literature reviews; evaluative, explorative, and instrumental review. Evaluative review focuses on discussing the published literature in terms of scope and addition to knowledge in the specific area of interest. It is usually employed to compare research results of a project of interest with findings from other similar projects. On the other hand, explorative review focuses on finding out what academic literature contains about a specific research topic in terms of empirical evidence, theories, and methodologies and is usually related to a larger subject area. Explorative review may be used to identify, highlight, or focus research questions that remain unanswered in the topic of interest. Finally, instrumental review seeks to figure out how to pursue some research on usually very narrow and specific research problem. It doesn't seek to define the most up-to-date knowledge in a specific are but to define the best way to conduct a research without consuming unnecessary cost, time, or other resources.

3.2 Exploratory Research

"A theory can be proved by experiment; but no path leads from experiment to the birth of a theory" Albert Einestein [19]. Explanatory research methodology is a

methodology used for hypotheses generation, understanding a concept, identifying the exact details of a research problem or determining the most important variables to be studied. Several forms of preliminary research have been categorized under the explanatory research umbrella. These forms include: pilot studies, secondary information analysis studies, case analysis, experience surveys and interviews. Because experience surveys will be employed in this work, the following lines will address this concept briefly.

Experience surveys involve interviewing knowledgeable people who may provide information that addresses the research questions. Sometimes experience surveys involve formal questionnaires, but most commonly, a researcher uses a list of topics to be discussed with the interviewee to gather information. In the latter case, the survey results are usually in the form of informal discussion which may be difficult to analyze especially if large number of people are interviewed. However, formal questionnaires have the advantages of gathering objective quantifiable data. Such data can be easily analyzed statistically and used for generating hypotheses about a certain topic or issue of interest, draw conclusions, identify important variables, or even propose a well-designed research protocol to furtherly investigate the topic of interest [20].

Exploratory research approach has several advantages over other research approaches. First, it is adaptable and flexible to change. Second, exploratory research is effective in building the basis for further and more conclusive research. Moreover, this approach has the potential to save time and resources by enabling researchers to ascertain the optimal design of research that is worth pursuing at an early stage. However, most exploratory researches output qualitative information that are difficult to analyze and/or interpret without high degree of bias and uncertainty. The samples studied in exploratory research are mostly of modest size that may not adequately represent the target population and results may not be generalizable [21].

The objective of an exploratory study is accomplished when the researcher is satisfied that he has defined the major dimensions of the research problem, developed ideas about potential causes or solutions to the research problem, gathered the sufficient data required for designing a furthermore conclusive study, or concludes that further research is not needed or not feasible due to time, financial or other constraints [21].

3.3 Questionnaire Design

The aim of this part of the study is to measure the acceptance of implementing and using UEMR in the Libyan healthcare institutions. Therefore, a questionnaire methodology is implemented with indicators compiled from several sources including Ajami, et al. (2011) [16], Al-Adwan & Berger (2015) [17], and Gagnon, et al. (2014) [18]. The questionnaire is designed into five main parts, which are:

1. Personal information
2. UEMR benefits and acceptance
3. UEMR challenges
4. Enhancement tools
5. UEMR overall acceptance evaluation

The personal information requested from the participants are their gender and occupation within the healthcare institutions. Moreover, the participants are asked if they are familiar with the concept of UEMR. In order to ensure a clear understanding of the concept, a definition of UEMR is provided within the questionnaire as the following:

"An internal system for healthcare providers within the healthcare institutions, which is used to store patient's data and information. The UEMR is used to enter diagnosis and treatment information by physicians, nurses, technical medical staff, and administrative staff working in the healthcare sector, during the visit of the patient. The aim of the system is to store data and information in order to facilitate an access to it, when needed."

This definition is developed by the researcher based on a global understanding of the concept and the definitions provided by the guidelines of World Health Organization (WHO) in WHO (2006) [2]. Moreover, since the literature suggests the impact of the healthcare provider's personality traints on the acceptance of UEMR implementation and usage [18], the researcher added a question in the first part to investigate the way healthcare providers describe their character. Four main traits are included, which are having good communication skills with coulegues, welcoming change, fast learning, and adaption to technological advances.

In the second part, several indicators as recommended by Al-Adwan & Berger (2015) are evaluted by the participants on a 6-point Likert scale. The scale is choosen

to increase reliability of the results [22]. Table 3.1 provides the items that evaluated under this part, which includes fifteen items.

Table 3.1: Items included to evaluate UEMR's benefits and acceptance.

Item Code	Item
BA1	Make me finish my tasks faster
BA2	Make me more efficient in completing my tasks
BA3	Give me the opportunity to focus more on the patient's condition
BA4	Increase the quality of healthcare service
BA5	Be professionally acceptable
BA6	Be socially acceptable
BA7	Increase productivity
BA8	Make providing healthcare services faster
BA9	Make finishing my tasks easier
BA10	Increase the quality of the work environment
BA11	Increase precision and reduce risk of error
BA12	Provide me with a better control over my work
BA13	Ease obtaining patient information
BA14	Facilitate communication between healthcare providers
BA15	Make providing healthcare services more organized and clearer

Furthermore, inverted scale questions are used in the third part to evaluate the challenges faced by imeplemeting and using a UEMR system. Table 3.2 provides the eight items included under this part.

Table 3.2: Items included to evaluate UEMR's challenges and issue (Inverted).

Item Code	Item
CI1	Increase the time of completing healthcare tasks
CI2	Increase the cost of healthcare service
CI3	Change the interaction with the patient
CI4	Change the way I take clinical decisions
CI5	Demand more effort from my side
CI6	Require more time from me to learn and adapt to it
CI7	Reduce my attention while performing my tasks
CI8	Increase the complexity of my tasks and the work environment

The fourth part of the questionnaire is designed based on the identification of two main tools that could enhance the implementation process and ease the navigation through the UEMR system, which are training and technical support. However, the aim of this part of the questionnaire is to understand the way these two tools could enhance the user's experience and make the system more reliable and comfortable to use. Therefore, the participants are asked to evaluate each of the two tools by choosing one or more from the following items:

1. Ease UEMR operations technically
2. Ease acquiring the needed skills
3. Makes UEMR more flexible in terms of operations and maintenance
4. Ease navigation through the system
5. Make user's experience more comfortable
6. Waste user's time and effort

The fifth and last part of the questionnaire provides an overall evaluation of the acceptance of UEMR in Libyan healthcare institutions using normal and inverted scales. The participants are asked to provide their agreement using a 6-point Likert scale on the items shown in Table 3.3.

Table 3.3: Items included to evaluate UEMR's overall acceptance.

Item Code	Item
OA1	Patients would accept implementing and using UEMR
OA2	My colleagues would accept implementing and using UEMR
OA3	I accept implementing and using UEMR
OA4	I believe that implementing and using UEMR is suitable for my specialty and work
OA5	I do not want the implementation and usage of UEMR and I believe the current system is sufficient and works well (inverted)

Based on the above indicators a network is constructed to calculate the behavioral intention, i.e. acceptance, towards UEMR as shown in Figure 3.1.

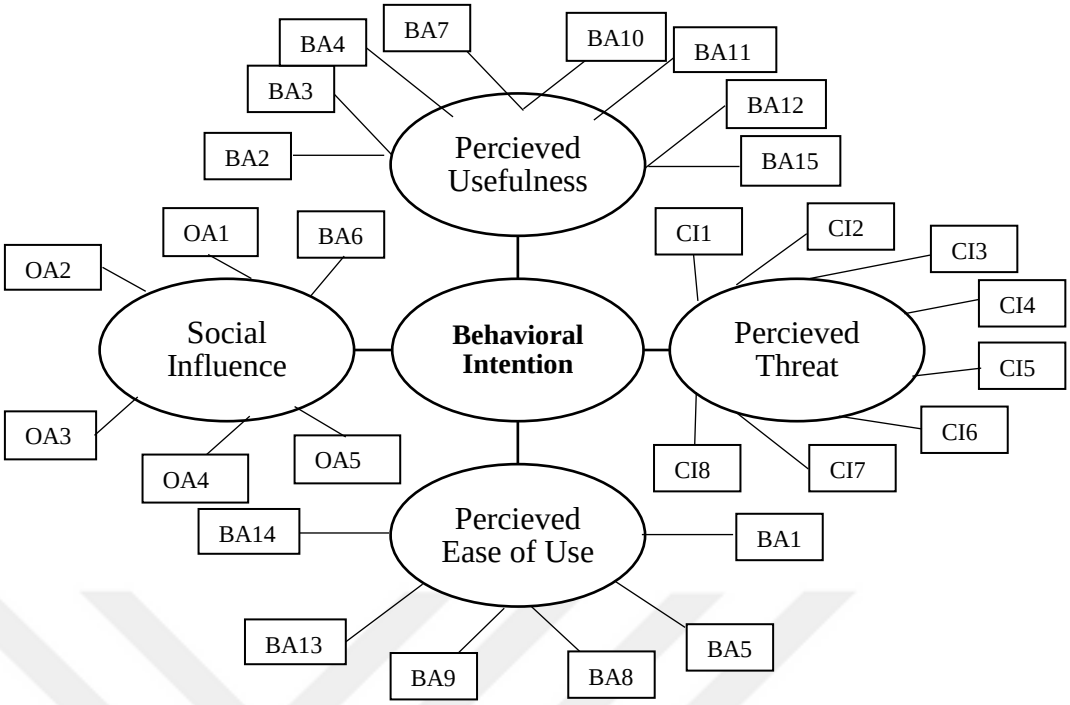

Figure 3.1: Indicators network to measure acceptance of UEMR in Libya.

3.4 Sample and Reliability

Since the aim of using a questionnaire methodology is to measure the acceptance of UEMR within the Libyan healthcare institutions, it is important to choose the sample based on their involvement within the sector. Thus, the sample is chosen from the different healthcare providers in Libya. The sample is collected using an online surveying platform and its link shared within Libyan healthcare communities on social media. During the six days launch of the survey, a total of 276 surveys were initiated by the participants, of which 188 were completed, and 88 are disqualified for not belonging to the Libyan healthcare sector or not completing the survey fully. The results are then entered into SPSS Statistics, where an overall reliability measurement using Cronbach's alpha is calculated as 0.755, which is considered acceptable [23]. Table 3.4 below shows Cronbach's alpha for the different elements of behavioral intention.

Table 3.4: Reliability analysis for behavioral intention elements.

Behavioral Intention Element	Cronbach's alpha
Perceived usefulness	0.887
Perceived threat	0.819
Perceived ease of use	0.815
Social influence	0.734

CHAPTER FOUR

UEMR ACCEPTANCE

4.1 Personal Information

As mentioned in the previous chapter, 188 participants belonging to the healthcare sector in Libya have completed the questionnaire (Template available in Appendix A). With regard to the demolgraphics of the participants, 78.72% of the participants are male, while 21.28% are female, as shown in Figure 4.1. The gender representation did not influence the reliability of the results as this parameter is independane from further analysis. Moreover, the participants are distributed among different occupation categories; however, 63.83% are physicians, which is the highest participation in the questionnaire, as shown in Figure 4.2. Other deciplines participated in the survey with technical staff forming 13.83%, pharmacistis 6.91%, healthcare management staff 5.85%, and other healthcare providers 9.57%, including nurses.

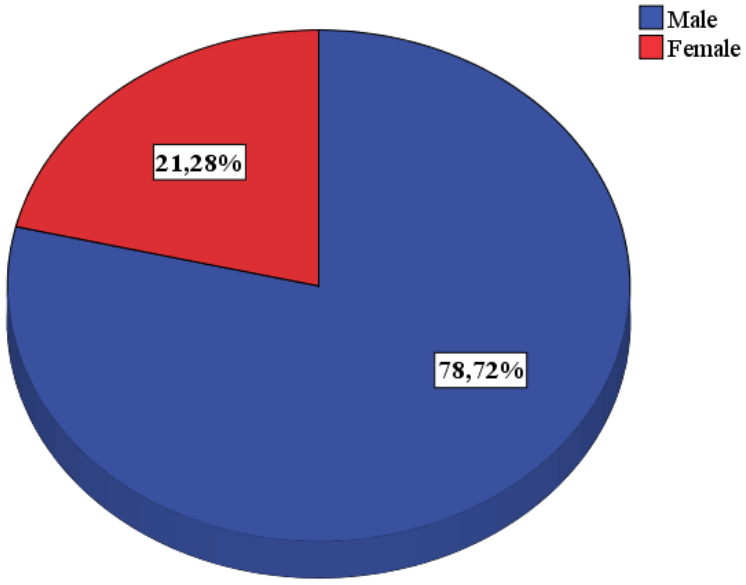

Figure 4.1: Gender of questionnaire participants.

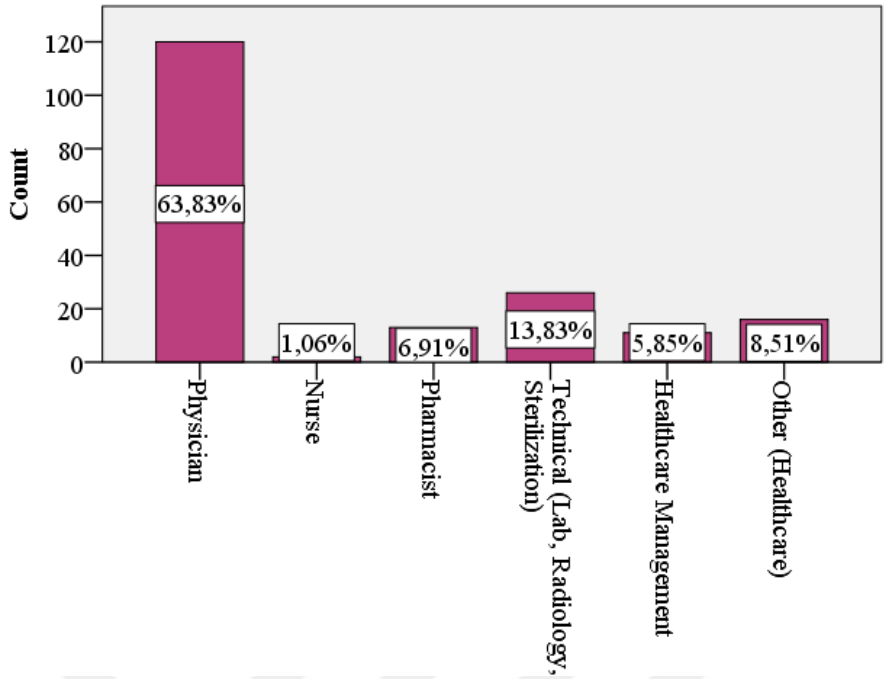

Figure 4.2: Occupation of questionnaire participants.

Furthermore, after providing a definition for the Unified Electronic Medical Record (UEMR) within the questionnaire, the participants were asked if they are familiar with the concept. As shown in Figure 4.3, 80.85% of the participants are familar with the term and functions, which reflects a significant awareness rate. The last question in this part asked the participants to select the personality charachters that apply to them, which were identified earlier as important for UEMR acceptance. Therefore, 70.7% and 69.7% have indicated that they have good communication with their collegues, and adaptive to new technology, respectively, as shown in Table 4.1. More than 55% have also indicated that they are fast learners and adaptive to changes in the work environment. Such results shows an indication for a good environment to implement UEMR that might have a good acceptance rate for the system implementation and usage.

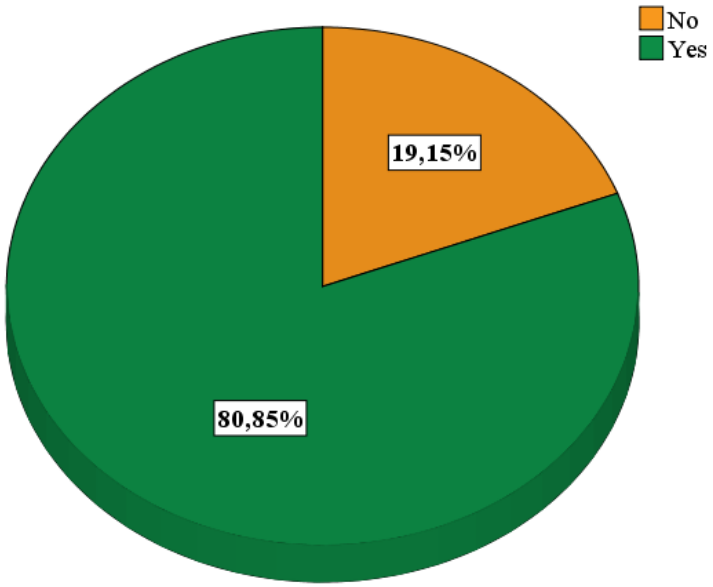

Figure 4.3: Familarity of participants with UEMR.

Table 4.1: Personality charachteristics of questionnaire participant for UEMR implementation.

Personality Charachteristics[a]	Responses		Percent of Cases
	N	Percent	
Communication with coulegues	133	26.9%	70.7%
Adaptive to change	123	24.8%	65.4%
Fast learner	108	21.8%	57.4%
Adaptive to new technology	131	26.5%	69.7%
Total	495	100.0%	263.3%

a. Dichotomy group tabulated at value 1.

4.2 Intentional Behavior Assessment

In the intentional behavioral assessment, dimensions are assessed; percieved usefulness, Percieved threat, percieved ease of use, and social influence, which are covered in this research to measure the acceptance of implementing and using UEMR in Libyan healthcare institutions. For percieved usefulness, eight items were tested as shown in Table 4.2. The highest mean scores are 5.46, which were achieved by two items; increasing the quality of healthcare service and making healthcare services more organized and clearer.

Table 4.2: Mean scores of indicators for perceived usefulness.

Item Code	Indicator	Mean Score	Std. Deviation
BA2	Make me more efficient in completing my tasks	5.20	0.918
BA3	Give me the opportunity to focus more on the patient's condition	5.12	0.980
BA4	Increase the quality of healthcare service	5.46	0.748
BA7	Increase productivity	5.07	1.026
BA10	Increase the quality of the work environment	5.31	0.781
BA11	Increase precision and reduce risk of error	5.30	0.889
BA12	Provide me with a better control over my work	5.28	0.845
BA15	Make providing healthcare services more organized and clearer	5.46	0.830
	Average Mean Score	5.275	
	Percentile	87.92%	

Therefore, these results indicate that the healthcare givers believe that implementing the UEMR in their institutions contributes mainly to the quality of healthcare services provided. All items under this category have achieved a mean score above 5, which shows that the participating healthcare givers percieve UEMR as a useful system for the health sector in Libya.

Table 4.3: Mean scores of indicators for perceived threat.

Item Code	Indicator	Mean Score	Normalized mean score *	Std. Deviation
CI1	Increase the time of completing healthcare tasks	3.54	2.46	1.685
CI2	Increase the cost of healthcare service	3.09	2.91	1.489
CI3	Change the interaction with the patient	3.77	2.23	1.494
CI4	Change the way I take clinical decisions	3.80	2.20	1.559
CI5	Demand more effort from my side	3.51	2.49	1.553
CI6	Require more time from me to learn and adapt to it	3.02	2.98	1.444
CI7	Reduce my attention while performing my tasks	2.54	3.46	1.350
CI8	Increase the complexity of my tasks and the work environment	2.37	3.63	1.316
	Average Mean Score	3.205	2.795	
	Percentile	53.42%	46.58%	

*. Normalized mean score is calculated as questions type is inverted

Moreover, indicators for percieved threats are included in the study, where inverted indicators were used. The results in Table 4.3 above show that changing the way the interaction with the patient is taking place and changing the way clinical decisions are make, are the most threats that are believed to be imposed by UEMR implementation and usage by the healthcare givers in Libya. The percpetion of the praticipats also showed high mean scores for the fear that UEMR would increase the time required to complete tasks, and demand more time and effort from the healthcare giver side. The normalized scores were also calculated for these items, since they are inverted questions and their average mean score is used to calculate the overall score for UEMR acceptance in Libya.

Table 4.4: Mean scores of indicators for perceived ease of use.

Item Code	Indicator	Mean Score	Std. Deviation
BA1	Make me finish my tasks faster	5.30	0.884
BA5	Be professionally acceptable	5.06	0.914
BA8	Make providing healthcare services faster	5.20	0.936
BA9	Make finishing my tasks easier	5.21	0.876
BA13	Ease obtaining patient information	5.63	0.662
BA14	Facilitate communication between healthcare providers	5.41	0.807
	Average Mean Score	5.302	
	Percentile	88.36%	

Furthermore, the indicators shown in Table 4.4 above are used to measure the perception of the participating healthcare givers in Libya for UEMR ease of use. The results show that ease in obtaining patient's information is the most agreed indicator with a mean score of 5.63, followed by facilitating communication between healthcare providers (5.41) and enabling healthcare providers to finish their tasks faster. All the mean scores under the ease of use are above 5, which indicates that the healthcare givers in Libya percieve the use of UEMR as a useful tool to ease their work tasks and procedures.

Table 4.5: Mean scores of indicators for social influence.

Item Code	Indicator	Mean Score	Std. Deviation
BA6	Be (UEMR) socially acceptable	4.49	1.072
OA1	Patients would accept implementing and using UEMR	4.45	1.086
OA2	My colleagues would accept implementing and using UEMR	4.72	0.975
OA3	I accept implementing and using UEMR	5.51	0.728
OA4	I believe that implementing and using UEMR is suitable for my specialty and work	5.40	0.791
OA5	I do not want the implementation and usage of UEMR and I believe the current system is sufficient and works well (inverted)	1.93 (4.07)	1.302
	Average Mean Score	4.77	
	Percentile	79.56%	

Mean score calculated between brackets ( ) are transformed from inverted mean score to a normalized mean score

The last indicator of the behavioral intention model is the social influence, where in this study six indicators were used for its measurement, as shown in Table 4.5. The participating healthcare givers confirmed that they personally accept the implementation and use of UEMR in their institution with a mean score of 5.51. Moreover, the results indicate that the participants believe that UEMR is suitable for their specialty and work. For social accpetance, mean scores of 4.72, 4.49, and 4.45 were indicated for the accpetance of UEMR among colleagues, society and petients. A final indicator using an inverted scale confirmed the personal accpetance of the participants for the UEMR system.

Based on the four behavioral intention factors reviewed above, the total mean scores of the model is shown in Table 4.6 below. The behavioral intention score for the accptance of implementing and using UEMR in Libyan healthcare institutions is calculated as 75.61%, which is considered an indication of a wide awareness and acceptance of the system. The main influence on pulling the score downwards is the percieved threat normalized score. Therefore, it is essential to ensure that any used UEMR system alleviate the disadvantages of the system and utilize the benefits.

Table 4.6: Behavioral intention score calculation for UEMR acceptance in Libya.

Behavioral Intention Element	Mean Score	Percentile
Perceived usefulness	5.275	87.92%
Perceived threat	2.795	46.58%
Perceived ease of use	5.302	88.36%
Social influence	4.77	79.56%
UEMR acceptance score	4.536	75.61%

4.3 Enhancement Tools

Through the literature review, two main factors were identified as two effective tools to enhance the experience with UEMR through smooth transitioning and adaptability; training and technical support. Therefore, these two factors were included in the questionnaire in order to understand their impacts, if they were adopted with UEMR implementation and usage. As shown in Table 4.7, participants indicated that the main advantages of implementing training for UEMR are easing operations technically, making experience more comfortable and easing the acquisition of the required skills by the healthcare givers in Libya.

Table 4.7: Influence of Training on UEMR implementation and usage.

Influence of training on UEMR[a]	Responses		Percent of Cases
	N	Percent	
Ease to operate technically	134	26.6%	71.3%
Ease to acquire skills	103	20.4%	54.8%
Ease operation and maintenance	81	16.1%	43.1%
Ease navigation	69	13.7%	36.7%
Makes experience more comfortable	107	21.2%	56.9%
Loss of time and effort	10	2.0%	5.3%
Total	504	100,0%	268,1%

a. Dichotomy group tabulated at value 1.

Furthermore, technical training showed similar results, where the highest advantage of implementing it with UEMR is easing operation from a technical point of view and easing operations and maintenance, as shown in Table 4.8. The final results confirm that these two tools are considered effective and have their positive impacts on UEMR imeplementation and usage.

Table 4.8: Influence of technical support on UEMR implementation and usage.

Influence of technical support on UEMR[a]	Responses		Percent of Cases
	N	Percent	
Ease to operate technically	115	24.7%	61.2%
Ease to acquire skills	89	19.1%	47.3%
Ease operation and maintenance	99	21.2%	52.7%
Ease navigation	66	14.2%	35.1%
Makes experience more comfortable	86	18.5%	45.7%
Loss of time and effort	11	2.4%	5.9%
Total	466	100.0%	247.9%

a. Dichotomy group tabulated at value 1.

CHAPTER FIVE

UEMR IMPLEMENTATION

5.1 Platform Overview

After calculating the acceptance of the UEMR and its significance in Libya, the researcher suggests a prototype platform that could form a cornerstone for further development. This implementation comes in line with the aim to provide healthcare services that improves the healthcare sector in Libya. Moreover, the proposed platform forms an electronic database, which could assist the decision makers in their tasks, as well as assisting physicians in more effective diagnosis through being able to view the health history of the patient. Figure 5.1 shows the control panel for the general director in UEMR system who may represent an Official in the Ministry of Health.

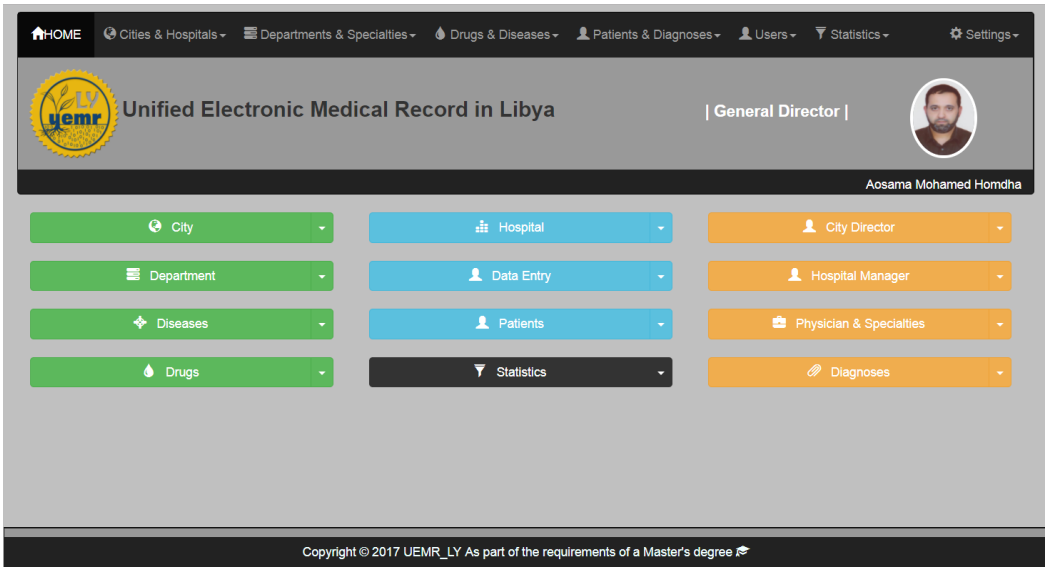

Figure 5.1: Control panel for the general director.

Furthermore, the platform allows the physicians and the healthcare providers in general to prepare clinical reports, issue prescriptions by authorized users, and produce statistics, which form important for decision makers. Such features allow healthcare

managers to strategize and develop short and long-term plans for their healthcare institutions. Figure 5.2 shows an example of the prescriptions that could be issued by physicians and statistical reports produced by the developed UEMR platform.

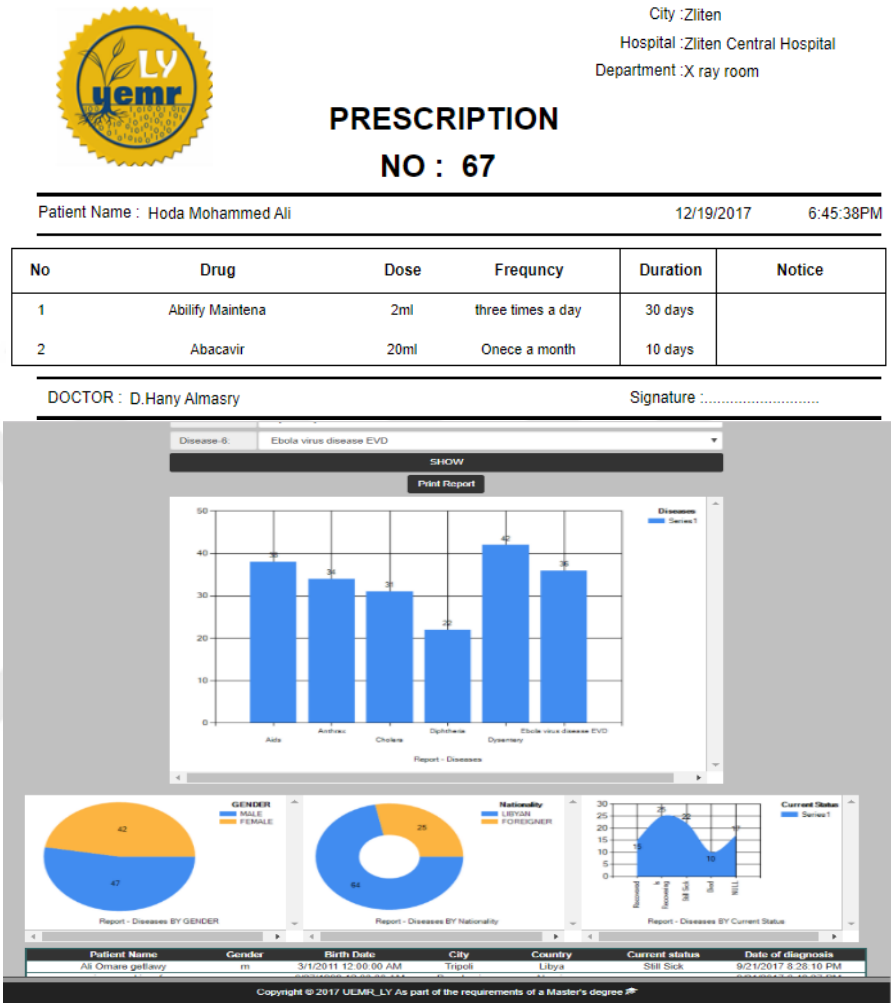

Figure 5.2: Example of prescriptions and statistical reports produced by the developed UEMR.

5.2 Platform Programming

The UEMR platform is developed using ASP.NET language, in addition to C#, CSS, JAVASCRIPT, JQUERY and AJAX. The database used is SQL SERVER. The platform is constructed in three layers:

1. First Layer (User Interface Layer)

This layer forms all of the platform pages, which are made using HTML & ASP.NET, CSS, AJAX, C# and JAVASCRIPT. These pages are the ones that the user interacts with directly for sending and receiving data.

2. Second Layer (Business Logic Layer)

In this layer all functions and procedures are written in a class named CLS_GENERAL.cs, which is considered as a connection point between the pages in the first layer and third layer (Database Access Layer). The procedures in the second layer operate on updating, addition, retrieving and deletion functions, which can be called through stored procedures prepared in the database.

3. Third layer (Database Access Layer)

In this layer the connection with the database is called through the "Connection String", stored in web.config file, which can be used when needed. Opening and closure connection function exists in this layer. The Third layer also contains a "Select" function, which is used in all data retrieving operations through storage in "Data Table". An "edit_delet_add" procedure is also used on editing, deletion and addition. The third layer is named CLS_DATA_ACCESS_LAYER.cs.

The database is dealt with through a group of stored procedures for each specific function, which is called through the second layer. Figure 5.3 shows Data flow diagram of three-layer architecture.

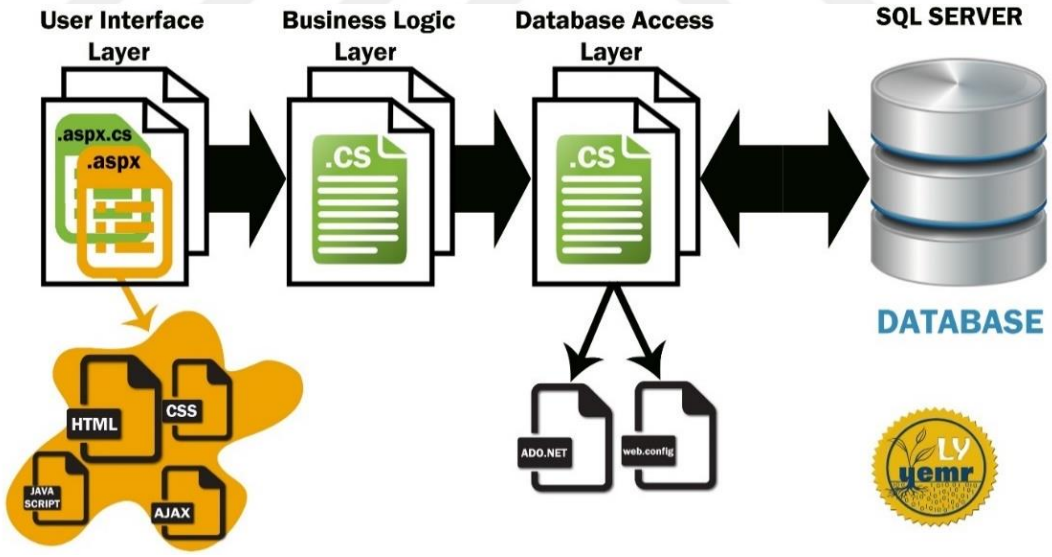

Figure 5.3: Data flow diagram of three-layer architecture.

In the databased, which is of SQL SERVER type and named UEMR_LY, a group of tables are created containing the necessary data for the system. Furthermore, a group of stored procedures were stored in the databased, which are used for addition, deletion, editing, as well as data retrieving.

There are several methods for images storage and retrieving; however, in the platform two ways were used:

1. Users' images: Since the users' images are relatively less than the other images, they were stored in the database in a table called "users" as an image datatype. The platform allows four types of personal pictures: .gif, .jpg, .png and .jpeg. Figure 5.4 shows an example of a user's image in the platform.

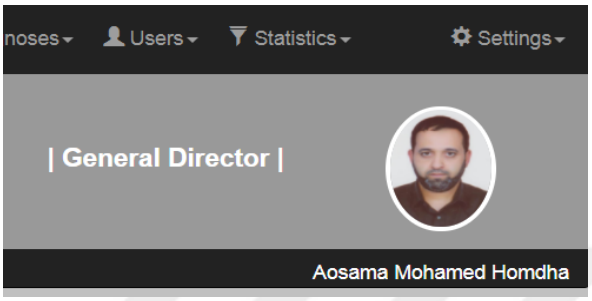

Figure 5.4: User's image in the UEMR platform.

2. Clinical/ Medical images: refers to radiology and MRI images taken by the healthcare technical staff. Since the volume of these images would require a higher storage space, they are saved in a separate folder called "uploads" outside the database, and their paths are stored in the database in a table called "T_Image". The platform allows three formats of clinical and medical images; .jpg, .png and .BMP. Figure 5.5 shows an example of the clinical/ medical images used in the UEMR platform.

Figure 5.5: Clinical/ medical image in the UEMR platform.

The platform consists of approximately sixty different pages and reports, which are managed depending on the type of the user, who differ based on their authority. A "Session" is used to protect the privacy of the pages and control the authorization of the users. Therefore, there are five types of users; General Director, City Director, Hospital Manager, Physician and Data Entry.

The majority of the pages were distributed into five folders depending on the type of the user, where a "Master Page" was made in each folder in order to specify the authorization properties. Moreover, the master pages specify the general appearance of the platform through using a unified frame with a specific colours and designs using CSS, JQuery and JavaScript files. The rest of the pages Inherit their appearance from the master pages. Additionally, Bootstrap service was utilized to obtain interactive pages fitting all screens' specifications, and providing an organized appearance and icons.

The "General Director" type of users has full authority to access all pages, except for the physician's authorities, where diagnosis and previous treatments for the patients can be viewed without the ability to edit, delete or alter them. This type of users has the only authority to access the "admin" files through the Master Page (Master_admin.master), as shown in Figure 5.6, which is inherited by all subsequent pages for this user. Moreover, the "General Director" user has pages that authorize editing, adding and deleting cities and city managers, as well as editing, adding and deleting medications/ drugs. This user has also the pages to authorize editing, adding and deleting clinical specialities and producing statistical reports on the country's level, as well as the ability to print them into hard copies.

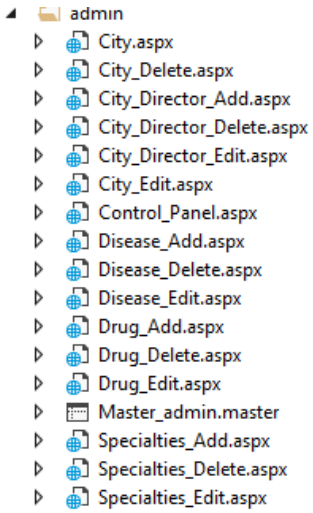

Figure 5.6: General Director's Pages

In addition to these authorities, the “General Director” user is authorized to access the pages of other types of users, who have less authority over the platform. Consequently, the “General Director” user can perform several statistical operations according to the city, healthcare institution, dates, patients’ nationalities, diseases. Through performing the statistical operations detailed reports and graphs can be produced by the platform.

The second type of user is called “City Director”, which is given to the health district manager in a certain city. All the pages for this user were placed in a folder called “City_Director”, which includes a master page named Master_City_Director.master, as shown in Figure 5.7. Through the master page, all other pages within folder and for this user inherit the specified authorities for it and the appearance. Each city health director has the authority to edit, delete and add hospitals that are within the city.

Moreover, the “City Director” user has also the ability to perform statistical operations for the city under the specified authority using specified conditions, such as date of births, time periods, patients’ nationalities, patients’ genders, and diseases. The statistical operations provide the option for the city director to represent the data through detailed reports and graphs. This user has the authority to access the pages of other users, who have less authority within the city.

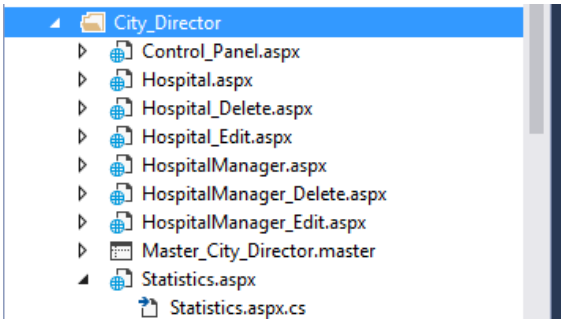

Figure 5.7: City Director’s Pages

The third type of user if named “Hospital Manager”, which assigned to the top authority of each hospital within a city. All the pages for this type of users is established in the folder “HospitalManager”, which contains a master page named Master_Hospital_Manajer.master, as shown in Figure 5.8, giving the authority for pager access and general appearance. Each hospital manager has the authority to edit, add and delete users within the specified hospital, without having this ability for other

hospitals. Authority is also given to this user to edit, add and delete departments within the specified hospital, in addition to employees and data entry staff.

Furthermore, this user does not have the authority to access the General Director and City Director pages, while having the ability to access the pages of other users within a specified hospital. However, this user cannot access the physicians' pages for editing, adding or deletion purposes, rather than viewing previous diagnosis, treatment and prescription data. Additionally, the hospital manager can perform statistical tasks using certain criteria such as patients' age, visit dates, nationalities, genders, as well as producing detailed reports and graphs for the specified hospital, and not other hospitals that do not fall under the user's authority.

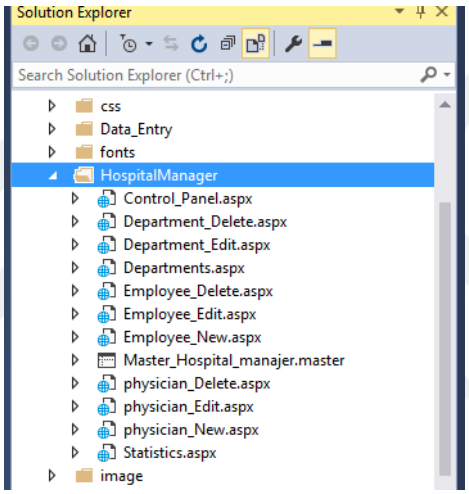

Figure 5.8: Hospital Manager's pages

The fourth type of user is called "Physician", where all the pages belonging to this user are placed under the folder "Physician". This user has a master page which gives the access authority to all other pages named Master_Physician.master, as shown in Figure 5.9, in addition to the general appearance of the pages. The authorities of this user through the master application prohibits other users from altering treatments and diagnoses for the patients; however, other users can view these information without being able to edit or delete them.

The "Physician" user can prescribe medications and write diagnostic and treatment information, while previewing previous entries. Additionally, this user can store clinical and radiology images, as well as reviewing data stored by other staff within the hospital about the patient. All treatment, diagnosis and prescriptions are

stored in a patient's electronic file without the ability for any user to edit or delete them, as they are considered a record that can be accessed when needed.

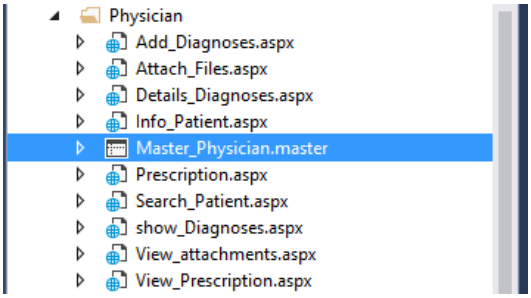

Figure 5.9: Physician's pages

The fifth and last type of users are called "Data Entry", which is usually assigned to the reception staff at the hospital. Therefore, the authorities given to this type of users are limited to the initial registration of the patients, as well as editing general data, such as; name, address, occupation, etc. All the pages for this user are located in the folder Data_Entry, which contains a master page named Master_Patient.master, as shown in Figure 5.10, limiting its authority and provides the general appearance for all the pages.

For patient's registration, the platform requires the national number for Libyan patients only and passport number for foreign patients. In this context, temporary solutions were adopted for patients who may not have a national number, such as new-borns, by using his guardian's national number until a number is acquired. The same process is adopted for foreign patients. For data protection purposes, data entry users are allowed to delete information for the hospitals they work for only.

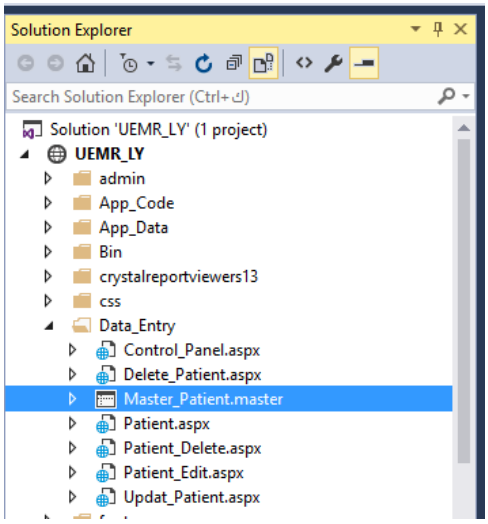

Figure 5.10: Data Entry's pages

Moreover, additional pages are produced including the main page of the platform, which can be used in the future as a news and advertising page covering activities in particular. This also includes Login page and page for change password in case the user need change it, as shown in Figure 5.11. Based on all the above-mentioned information, the master map of the platform is provided in Figure 5.12.

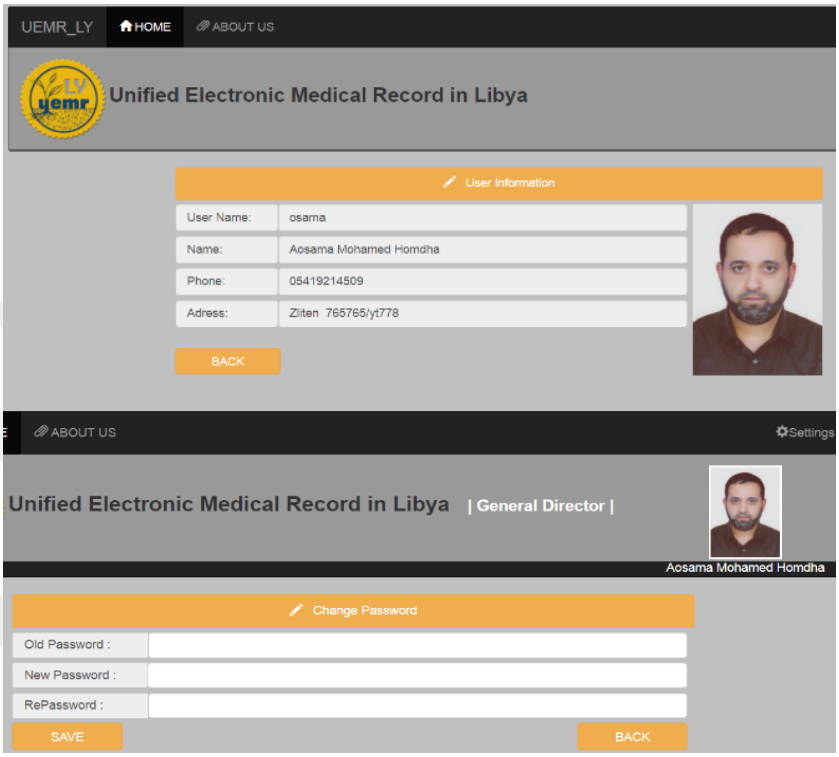

Figure 5.11: Additional pages for login and password reset

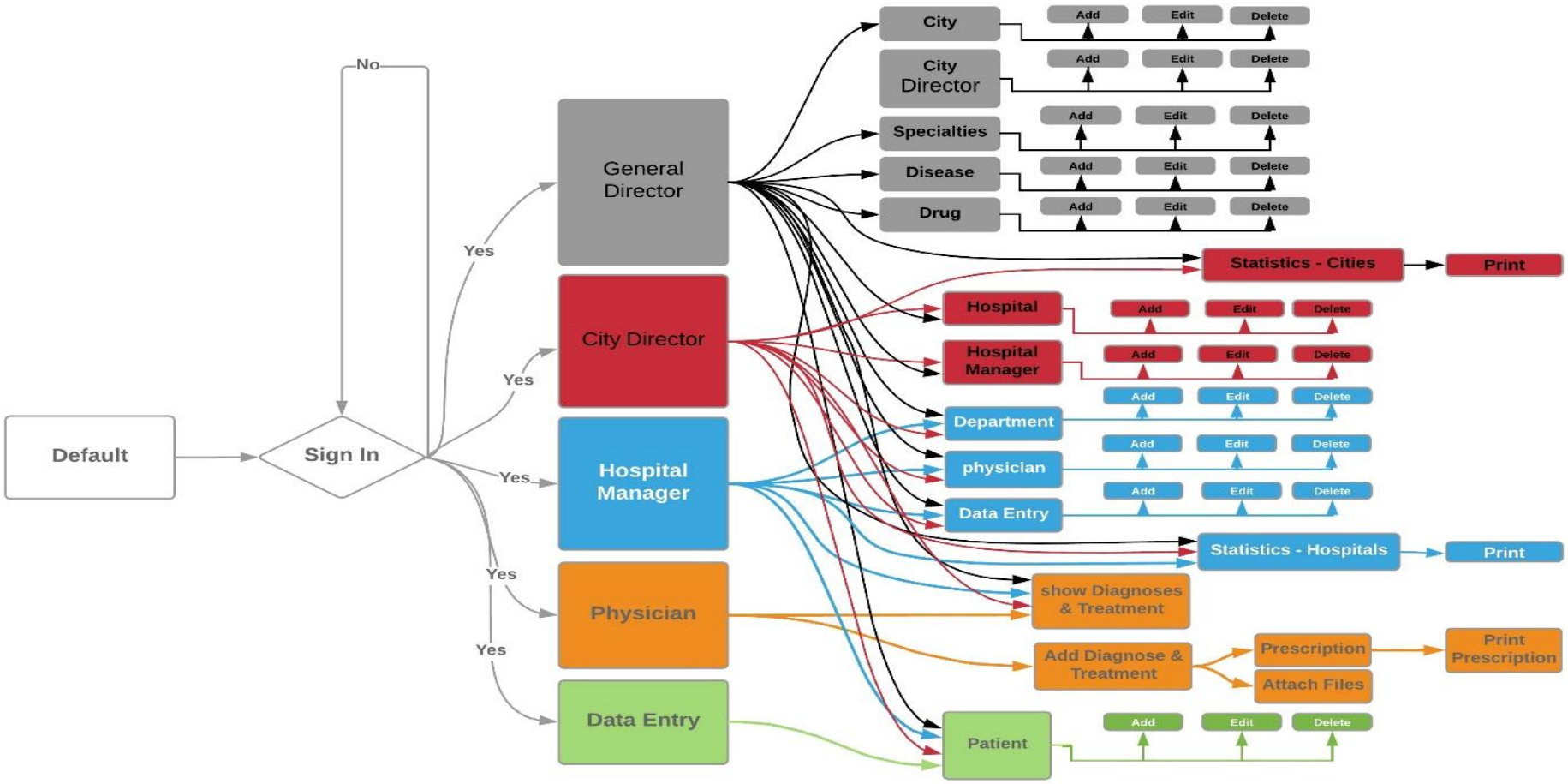

Figure 5.12: UEMR platform map

CHAPTER SIX

DISCUSSION AND CONCLUSION

The Unified Electronic Medical records (UEMR) refers to a system for healthcare providers within the healthcare institutions, which is used to store patient's data and information. The UEMR is used to enter diagnosis and treatment information by physicians, nurses, technical medical staff, and administrative staff working in the healthcare sector, during the visit of the patient. The aim of the system is to store data and information in order to facilitate an access to it, when needed. Similar concepts were developed in the past, such as Automated Health Records (AHR), Computer-based Patient Record (CPR), and Electronic Health Record (EHR). Nonetheless, all of those concepts differ according to operations and functionalities included within the system.

This research carried two main aims, which are evaluating the acceptability of implementing and using UEMR among Libyan healthcare givers, and designing a prototype platform that could form the cornerstone to an operational system in Libya. Several functionalities are identified for UEMR that have clinical and administrative natures. The main aim of the system is to keep the medical history of the patient at the user's fingertip in order to ease access, communication and healthcare service providing. The UEMR is provided for the different clinical and administrative staff of the country's healthcare organization including hospitals in order to record diagnosis and treatment data at each hospital visit. These data are used for future treatments, as well as performing statistical reporting that could help in strategic decision making.

The main advantages of the UEMR system are allowing proactivity in healthcare practices, easing medical records auditing, facilitating reporting activities, increasing patient's satisfaction, and empowering clinical and management decision-making process. Despite the many operational and administrative advantages, there are disadvantages to implementing UEMR, including its high costs for development and

operation, increase of medical errors due to errors by data entry or suggested content, and lowering physicians' productivity, as shown by Noraziani, et al. (2013) and confirmed by the results of the questionnaire in Table 4.3.

There are several challenges that face implementing and using UEMR in healthcare institutions, including:

1. Technically challenging system design and complexity.
2. Designing the system without considering the type of knowledge that are available by the users.
3. Using a workflow system that confuses the users.
4. Having a type of information that cannot be changed in the system without a high-level authorization.

The literature shows that there are two effective strategies that can be implemented to reduce the challenges of implementing and using UEMR system, which are providing training for the system users and technical support in order to increase the reliability of the system. These results are confirmed through the case study of this research, as shown in Tables 4.7 and 4.8.

The case study of this research is divided into two main steps:

1. Conducting a questionnaire to measure the acceptance of the UEMR in the Libyan Healthcare organizations.
2. Developing a prototype UEMR platform that could be considered as a starting point for a future system.

A behavioural intention model is adopted in order to measure the acceptance of UEMR system in Libya, with four main elements; perceived usefulness, perceived threat, perceived ease of use, and social influence. Several items were also compiled from the literature and set as indicators for the measurement of the four elements. Through surveying 188 participants, of which 63.83% are physicians in Libyan healthcare institutions, the perceived usefulness achieved a mean score of 5.275 on a 6-poitn scale, perceived threat achieved 2.795, perceived ease of use obtained 5.302, and social influence gained 4.77. The final UEMR acceptance score is calculated as 4.536 (75.61%), which is considered an indication of the awareness and acceptability of the UEMR system in Libya.

Furthermore, a prototype system that is designed using ASP.NET language, in addition to several other languages including C#, CSS, JAVASCRIPT, JQUERY and

AJAX. The platform consisted of three layers, which are; user interface layer, business logic layer, and database access layer. Moreover, five different types of users are identified; general director, city director, hospital manager, physician and data entry. The different levels of users have different authorities and task abilities depending on a separate. These authorities for each type of users ensure the workflows properly. In addition, this system preserves the privacy of all users, especially physicians, and maintains significantly the health data of patients from deletion or change. The platform map is presented in Figure 5.12.

Through the research performed in the literature review and the case study, the researcher recommends implementing the UEMR system in Libya as a high acceptability rate is recorded among the healthcare givers in the Libyan healthcare institutions. Moreover, trainings on UEMR and technical support shall be provided in order to enhance operations and facilitate a smooth adaptability to the new system. Further system development is required to test the UEMR operationally through a pilot study. Therefore, the currently presented UEMR can be considered an important step towards a better control and record system for the healthcare sector in Libya.

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APPENDIX A

(QUESTIONNAIRE TEMPLATE)

UEMR Acceptance in Libyan Healthcare Organizations

Dear Participant,

The following questionnaire aims to measure the acceptance of using Unified Electronic Medical Records (UEMR) in Libyan healthcare institutions, as part of a master's research in Turk Hava Kurumu (THK), Ankara, Turkey. Participating in this study could help develop healthcare management in Libya. Therefore, please take few minutes of your time to provide us with the best of your knowledge about the subject.

Best Regards
Aosama M.S Hmodha – Master's Degree Candidate
Turk Hava Kurumu

Part 1: Personal Information

Q1: Gender	Male	Female
Q2: Occupation	Physician	Nurse
	Pharmacist	Technical (radiology, lab, sterilization)
	Healthcare management	Other healthcare
Q3: Are you familiar with UEMR?	Yes	No
Q4: Kindly choose the personality traits that fit you.	Communication skills with colleagues	Welcoming change
	Fast learner	Adaptive to technological advances

Part 2: UEMR Benefits

Q5: From my viewpoint and experience, implementing UEMR will ...	**I totally disagree**	**I disagree**	**I slightly disagree**	**I slightly agree**	**I agree**	**I totally agree**
1. Make me finish my tasks faster						
2. Make me more efficient in completing my tasks						
3. Give me the opportunity to focus more on the patient's condition						
Q5 (Continued)	**I totally disagree**	**I disagree**	**I slightly disagree**	**I slightly agree**	**I agree**	**I totally agree**
4. Increase the quality of healthcare service						
5. Be professionally acceptable						
6. Be socially acceptable						
7. Increase productivity						
8. Make providing healthcare services faster						
9. Make finishing my tasks easier						
10. Increase the quality of the work environment						
11. Increase precision and reduce risk of error						
12. Provide me with a better control over my work						
13. Ease obtaining patient information						
14. Facilitate communication between healthcare providers						
15. Make providing healthcare services more organized and clearer						

Part 3: UEMR Challenges

Q6: From my viewpoint and experience, implementing UEMR will ...	**I totally disagree**	**I disagree**	**I slightly disagree**	**I slightly agree**	**I agree**	**I totally agree**
1. Increase the time of completing healthcare tasks						
Q6: (Continued)	**I totally disagree**	**I disagree**	**I slightly disagree**	**I slightly agree**	**I agree**	**I totally agree**
2. Increase the cost of healthcare service						
3. Change the interaction with the patient						
4. Change the way I take clinical decisions						
5. Demand more effort from my side						
6. Require more time from me to learn and adapt to it						
7. Reduce my attention while performing my tasks						
8. Increase the complexity of my tasks and the work environment						

Part 4: Enhancement Tools

Q7: UEMR training would ...	Ease its operation technically	Ease acquiring the skills needed
	Make it more flexible in terms of operations and maintenance	Ease navigation
	Make my experience as a user more comfortable	Waste my time and effort
Q8: UEMR technical support would ...	Ease its operation technically	Ease acquiring the skills needed
	Make it more flexible in terms of operations and maintenance	Ease navigation
	Make my experience as a user more comfortable	Waste my time and effort

Part 5: UEMR Acceptance Overall Evaluation

Q9: Do you agree to the following statements?	**I totally disagree**	**I disagree**	**I slightly disagree**	**I slightly agree**	**I agree**	**I totally agree**
1. Patients would accept implementing and using UEMR.						
2. My colleagues would accept implementing and using UEMR.						
3. I accept implementing and using UEMR						
4. I believe that implementing and using UEMR is suitable for my specialty and work						
5. I do not want the implementation and usage of UEMR and I believe the current system is sufficient and works well						

Thank you for your time and effort!

CURRICULUM VITEA

PERSONAL INFORMATION

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Marital Status : Married.
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EDUCATION

High School: Zliten - 1995.
Undergraduate: Higher Instructors Institute-Zliten / Electronic Engineering / Majoring in Computer / 98-1999.

WORK AND SKILLS

The Libya Ministry of Health since 2002 in Department of Information Technology as technical support engineer.

COMPUTER SKILLS

Operating systems, programming languages, and courses:
Delphi language – ASP.net – C# - C++ - Windows 2003 server
Telemedicine systems (WHO 2006).