

An-Najah National University
Faculty of Graduate Studies

**Enabling and Restricting Factors That Affect
the Adoption of Electronic Health Records
(EHRs) in the Palestinian Public Healthcare
System**

By
Maryam Sofian Ali Samara

Supervisors
Dr. Rani Shahwan
Dr. Nidal Dwaikat

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By


Maryam Sofian Ali Samara

This thesis was successfully defended on 06/11/2021 and approved by:

Defense Committee Members

Signature

- Dr. Rani Shahwan / Major Supervisor


.....

- Dr. Nidal Dwaikat / Co-Supervisor


.....

- Dr. Saad Zighan/ External Examiner

S. Zighan
.....

- Dr. Mohammad Othman / Internal Examiner


.....

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Dedication

To my parents and supervisors, who guided me to the right path with
their generous advices, efforts, and patience.

Acknowledgment

First and foremost, I would like to thank my father for his ongoing encouragement throughout my post-graduate journey. I truly acknowledge the support and assistance of my mother and colleagues. Also, I would thank my supervisors Dr. Rani Shahwan and Dr. Nidal Dwaikat for their valuable notes.

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الإقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل عنوان

Enabling and Restricting Factors That Affect the Adoption of Electronic Health Records (EHRs) in the Palestinian Public Healthcare System

أقر بأن ما اشتملت عليه هذه الرسالة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أية درجة علمية أو بحث علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted by others elsewhere for any other degree or qualification.

Student Name:

اسم الطالب: مريم سفيان علي سمارة

Signature

التوقيع: Mary

Date

التاريخ: 6-11-2021

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Abbreviation Table

Abbreviation	Description
HCPs	Healthcare Professionals
HIS	Health Information System
EHR	Electronic Health Record
EMR	Electronic Medical Record
IT	Information Technology
HIT	Health Information Technology
PHR	Patient Health Record
MMS	Military Medical Services
MOH	Ministry of Health
EP	Electronic Prescription
CPOE	Computerized Physician Order Entry
EPR	Electronic Patient Record
PBHR	Paper Based Health Record
PHR	Patient Health Record
WHO	World Health Organization
PHC	Primary Health Care
PMC	Palestine Medical Complex
UPS	Uninterruptible Power Supply
USAID	United States Agency for International Development
ID	Identification
PMOH	Palestine Ministry of Health
ACHs	Arab Countries Hospitals
ICD	International Classification Diseases

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ICU	Intensive Care Unit
ROI	Return On Investment
IS	Information System
X-ray	X-radiation
CT / CAT	Computed Tomography Scan
ECG	Electrocardiogram
MRI	Magnetic Resonance Imaging
Paltel	Palestine Telecommunications Company
CDSSs	Clinical Decision Support Systems
HIV	Human Immunodeficiency Virus
COVID-19	Coronavirus Disease of 2019
DC	Data Centre
GT	Grounded Theory
HIE	Health Information Exchange

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Abstract

Electronic health records (EHRs) are one of the health information technology (HIT) applications that aim to enhance public healthcare by delivering high-quality cures and ensuring patient safety. Despite the multiple benefits of the electronic health system for patients and health providers, there are still obstacles that restrict the successful adoption and implementation of EHRs.

This study qualitatively explores and identifies the key facilitators that support EHRs adoption and the key barriers that limit EHRs implementation. Besides, the study established a theoretical framework of enabling and restricting factors.

The study's methodology is based on a qualitative analysis of semi-structured interviews. The sample of the study includes twenty-six clinical and non-clinical staff across six Palestinian public hospitals.

The analysis revealed that there are three enabling factors and five restricting factors in addition to the theoretical model. The five major barriers include system limitations and drawbacks, lack of connectivity between different stakeholders, human negative practices, resources

issues, and system inefficiencies. The three major facilitators include cognitive acknowledgment toward the EHR system, smooth flow of information, and previous handwritten records experience. Furthermore, the study provides a theoretical framework of enabling and restricting factors that affect and limit the EHRs adoption and implementation across Palestinian governmental hospitals from HCPs' perspectives and experience.

All occurred barriers and facilitators that emerged in enabling and restricting factors are categorized into five major barriers and four major facilitators to form an inclusive understanding of the current status of EHRs. The financial, technical, human, time, in addition to organizational barriers, are the five major categories of barriers and challenges that restrict the successful implementation of EHRs. On the other hand, the previous experience with paper-based records, Avicenna HIS features, human, and organizational facilitators are the four major categories of facilitators that support the successful implementation of EHRs.

Finally, the study provides practical implications for both healthcare executives and stakeholders. The healthcare executives and stakeholders are recommended to sustain the research facilitators and strengthen them effectively to ensure the sustainability of electronic health system execution. For said obstacles, stockholders and healthcare executives can overcome them or minimize their negative impacts by following the

research implications to handle the aforementioned obstacles effectively. For the knowledge contribution, the researchers are recommended to pay attention to the research future studies to enhance the reality of EHRs in the Palestinian health sector. Future investigations are necessary to validate the kinds of conclusions that can be drawn from this study.

Chapter one

Introduction

This chapter introduces a general background of research contents by presenting the research objectives, research problem statement, research methodology, research significance, and thesis structure to form an inclusive understanding of research content.

1.1 Background

This study constitutes a relatively new area that has emerged from the importance of the healthcare system. In fact, innovation in the healthcare context (Healthcare Information Technology) has been relied upon to align the possibilities to achieve better information flow, services, and comply with organizational objectives for high-quality patient care and treatment (Cleven et al., 2016).

The health sector is evolving and growing continuously. Consequently, hospitals and healthcare institutions are keen to integrate the latest technologies to provide sustainable services for patients. Health Information System (HIS) includes many applications, and all these applications have the same goal; saving people's lives through providing high-quality treatment (Lærum, 2004).

The successful implementation of EHR requires ongoing and robust interaction and communication among physicians, pharmacists, nurses, and

patients for better health delivery (Gupta & Murtaza., 2009; Leeming et al., 2019).

Electronic records have clear benefits to healthcare providers, including accurate diagnostic, reduction of medication errors, documentation, usability, and access to the patient records from remote areas. Besides, physicians can restore, modify, arrange, and display the data quickly. Hence, EHR adoption increased from 9% in 2009 to 96 % in 2015 by non-federal acute care hospitals (Henry et al., 2016). This rapid growth has been linked to the failure of the traditional paper-based records system, which is characterized by the lack of privacy and security, large storage space, unorganized records, duplication, lack of accuracy, and the need for health insurance companies to prevent fraud. Retrieving a traditional medical record also consumes a lot of time and effort, especially for patients suffering from various chronic conditions. Furthermore, manual records are inaccessible from a remote location and have an inflexible data storage format (Hersh, 1995).

In Palestine, the used HIS system is called Avicenna; the Avicenna system is extended EHRs. Between 2008 and 2014, the Palestinian Ministry of Health (PMOH) partnered with USAID to develop and reform the Palestinian health sector via a flagship project. As a result, the Avicenna HIS system was implemented in clinics, hospitals, and PMOH offices. Avicenna HIS software was designed by DataSel (a Turkish software company) and implemented by Dimensions (a local IT company); they are leading

Avicenna. It is worth mentioning that the implementation process was done in collaboration with CMC, Cisco network, and Ultimate. Paltel provides the connectivity (fiber optic) to facilitate access to the data center (DC), where all PMOH data is stored in DC, which is located at Palestinian Medical Complex (PMC), where the Palestinian government paid the connectivity fees (HEALTH INFORMATION SYSTEM (HIS) ASSESSMENT REPORT, 2015).

1.2 Problem Statement

In the West Bank, all governmental hospitals that work under the supervision of the Palestinian Ministry of Health are linked together through Avicenna HIS. Despite the multiple benefits of electronic health records to end-users, there are still some limitations that restrict the EHRs adoption and implementation across Palestinian public hospitals in West Bank (Shawahna et al., 2019). This remains an open problem in the area. It is essential to address the potential barriers that affect the EHRs implementation based on physicians' perspectives (Boonstra & Broekhuis, 2010).

The current problems are related to factors that affect daily medical and administrative duties for clinical and non-clinical groups across the hospital's wards and departments. This problem has received substantial interest. Therefore, this research aims to explore and identify the restricting and enabling factors that affect technological innovation adoption and implementation in PMOH hospitals from HCPs perspectives and experience

to provide a theoretical framework that clarifies how these factors affect and limit the process of EHRs adoption in the Palestinian public healthcare system.

1.3 Research Questions

The research involves the exploration of the following questions

1. How do healthcare professionals (Doctors, Pharmacists, and Nurses) and non-clinical groups ensure the uniform adoption of EHRs across public hospitals?
2. What are the enabling factors (facilitators) that support the EHRs adoption and implementation in public hospitals?
3. What are the restricting factors (barriers) that restrict the EHRs adoption and implementation in public hospitals?

1.4 Research Objectives

This exploratory qualitative study has been conducted in a developing country, which aims at the basis of HCPs' experience and perspectives to investigate the current status of EHRs in Palestinian governmental hospitals. The primary research objectives include the following:

- A. Explore the ward-level implementation of EHRs and identify the role of HCPs and non-clinical groups in ensuring a uniform adoption of EHRs across public hospitals.

- B. Identify the enabling factors (facilitators) that support the EHRs adoption and implementation in public hospitals.
- C. Identify the restricting factors (barriers) that restrict the EHRs adoption and implementation in public hospitals.

1.5 Significance of the Research

This thesis documents several key contributions made to the fields of the healthcare system in Palestine. According to the previous academic studies, in developing countries, particularly in Palestine, there are no published studies that qualitatively explore and address the facilitators and barriers that affect and limit the EHRs implementation based on HCPs perspectives across Palestinian public hospitals. Thus, for the knowledge contribution, the research aims to identify the key factors influencing electronic health records (EHRs) adoption and implementation in Palestinian public hospitals. The contributions made should be of wide interest. Identifying the different views and perceptions regarding electronic health records would give a strong foundation to build a case for best practices within the hospitals.

Despite potential benefits of HIT, there are still limitations and barriers that may hinder or restrict the successful implementation of EHRs; therefore, understanding major drawbacks and benefits will result in effective HIT integration and execution on a large scale, besides, overcome healthcare problems through an effective solution that fit change process (Kimble & Massoud, 2021).

The study targets the government health sector. Therefore, the PMOH executives and stakeholders are recommended to sustain the research facilitators and strengthen them to ensure the sustainability of electronic health system execution. For the mentioned obstacles, stockholders and healthcare executives can overcome them or minimize their negative impacts by following the research implications to handle said obstacles effectively. This presents some practical advantages.

By preserving and maximizing facilitators, as well as avoiding and minimizing barriers, the sustainability of the execution of technological innovation within the Palestinian health system will be ensured. Thus, as a result, the quality of health services will be enhanced. The sustainability of EHRs implementation, besides the high quality of provided health services, are beneficial for HCPs, government, and stakeholders as well as patients.

HCPs can consider said barriers, especially the human barriers to avoid them. Also, they can consider facilitators as motivators. On the other hand, the government can consider the research implications to enhance the reality of EHRs in governmental hospitals. For example, the government finds another alternative financial source rather than USAID to handle the financial barriers effectively. In addition, the PMOH can consider the aforementioned obstacles particularly the organizational barriers. Also, they can take into account the research implications. For instance, the PMOH links the key relevant stakeholders to enhance the interconnectivity in the Palestinian health system.

For the knowledge contribution, the researchers are recommended to pay more attention to the research future studies to enhance the reality of EHRs in the Palestinian health sector.

1.6 Research Methodology

This study uses semi-structured interviews to collect qualitative data from twenty-six clinical and non-clinical health workers in six Palestinian governmental hospitals. These hospitals are Jenin Governmental Hospital, Rafidia Hospital, Nablus National Hospital, Palestine Medical Complex, Tubas Turkish Governmental Hospital, and Thabet Thabet Governmental Hospital. These hospitals are located in various parts of the West Bank, including Jenin, Nablus, Tubas, Tulkarm, and Ramallah. The study follows the grounded theory approach. The interviews are collected, transcribed, and analyzed through the Maxqda software program.

1.7 Thesis Structure

The research includes five chapters, as shown in Figure 1.1

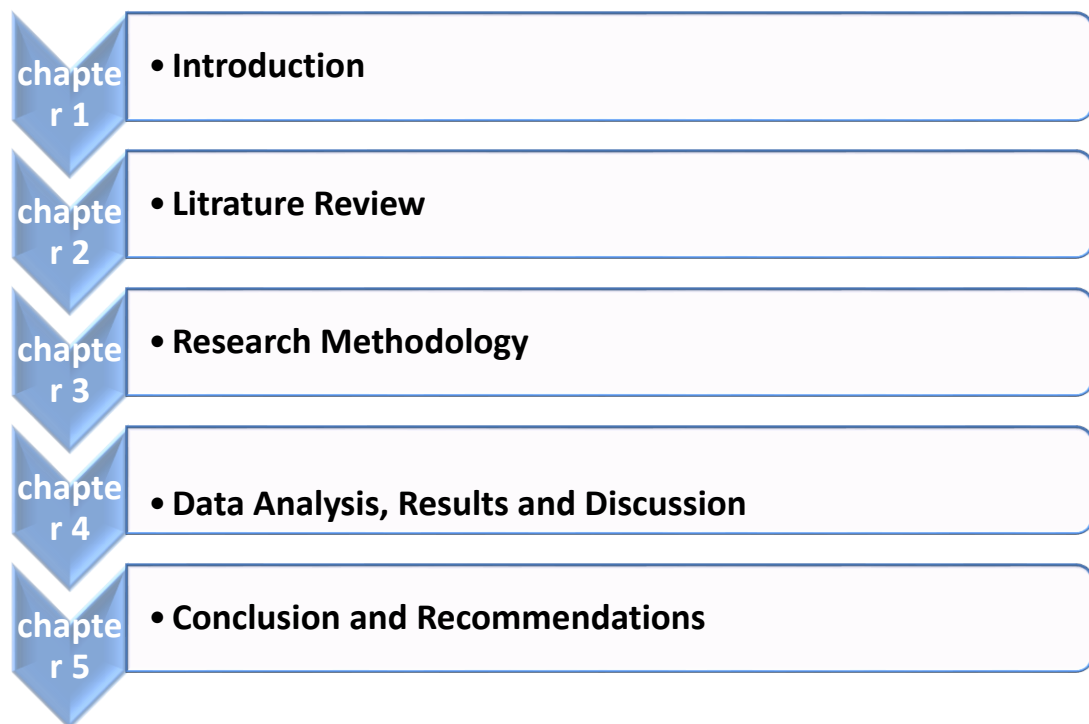


Figure 1.1: Thesis Structure.

Chapter one presents the introduction, which introduces the general background of research contents by presenting the research questions, research objectives, research problem statement, research methodology, research significance, and thesis structure.

Chapter two presents the literature review. This chapter introduces the relevant previous academic studies and literature. The literature review is grouped into six groups: First, definitions of innovation and innovation in healthcare. Second, factors of innovation adoption and implementation in healthcare. Third, barriers to health information technology (HIT) adoption and implementation. Fourth, benefits of health information technology (HIT) adoption and implementation. Fifth, facilitators of health information technology (HIT). Finally, applications of health information systems (HIS).

Chapter three presents the research methodology. This chapter outlines the research tools and methods that the researcher used to collect, analyze and interpret the data. In addition, it presents a general overview of methodology definition and research approaches. Besides, illustrate the philosophical assumptions of qualitative research. As well the validity and reliability of the research, in addition to the research design.

Chapter four presents the data analysis, results, and discussion. This chapter introduces the study findings, key themes, and sub-themes that emerged from the analysis. In addition, it presents a theoretical framework of enabling and restricting factors of EHRs adoption and implementation. Besides, it includes a discussion of the research findings in the light of previous studies.

Chapter five presents the research conclusion and practical implications in addition to the study limitations.

Chapter Two

Literature Review

This chapter presents academic literature about health information systems (HIS). This has been discussed by a great number of authors in literature. Literature reviews are classified into six major domains; First, definitions of innovation and innovation in healthcare. Second, factors of innovation adoption and implementation in healthcare. Third, barriers to health information technology (HIT) adoption and implementation. Fourth, benefits of health information technology (HIT) adoption and implementation. Fifth, facilitators of health information technology (HIT). Finally, applications of health information systems (HIS).

2.1 Definitions of Innovation and Innovation in Healthcare

A series of recent studies have indicated that this term is not new. In fact, it was used previously in many sectors, such as marketing, politics, economy, and business. Such sectors used innovation to solve current problems and find effective solutions for them. In healthcare, innovation means providing novel and effective ideas, products, services, care, as well as technologies, procedures, and methods (Kimble & Massoud, 2021). It also means invention, adoption, and diffusion, where the desired and useable innovation result in sustainable and accurate medical service (Thakur et al., 2012).

Previous research by Evangelista and Sirilli (1995), and Cooper et al. (1994) defined innovation as a new service to an organization. According to

Damanpour and Even (1984) and Thakur et al. (2012), innovation is a valuable change that enables organizations to cope with uncertainties, and enhance goal achievement levels by successfully integrating new technical changes or new administrative changes to organizational structure. In addition, it allows HCPs to work smarter, faster, and cost-effectively while providing high-quality healthcare.

Scholars have defined innovation in many ways “ranging from very broad and impressive generalizations to highly specific focusing on technical innovations” (Suanj, 2000, p.350). According to Lynn and Gelb (1997, p.44), innovation is the “tendency of an individual consumer to adopt new products before large numbers of others do”.

2.2 Factors of Innovation Adoption and Implementation in Healthcare

Most HIT studies were examined and evaluated through organizational, financial, and technical perspectives; therefore, scholars emphasize the shift from a technical standpoint (technical aspects) to considering inclusive and different perspectives when investigating HIT adoption and implementation by considering political, social, economic, cultural, and organizational factors (Andargoli et al., 2017).

A number of authors such as Boonstra and Broekhuis (2010) list eight categories of inter-related factors that must be considered when executing an electronic health system, 1. Financial (fund, money, and cost); 2. Technical (lack of computer skills, training, and system complexities); 3. Time (the

time it takes to learn on a new system, besides the time it takes to select, execute system, and convert paper to electronic); 4. Organizational size (large one find easy to execute EMR); 5. Change process (supportive organizational culture); 6. Social (perceived impact on dynamics of the doctor-patient relationship, lack of management support); 7. Psychological (lack of beliefs how EMR enhances care) and 8. Legal (authority, accessibility, and standards).

Some authors bring some information about the background of the innovation. Cresswell and Sheikh (2013) conclude that social, organizational, and technical factors should be considered to ensure that technological innovation is useful for individuals and organizational processes. Another study carried out by Talukder (2012) mentions that organizations should consider adopters' acceptance and attitude by considering factors that affect innovation, where the employees' innovation adoption in an organizational context is affected by: 1. Organizational factors (training, management support, and incentives); 2. Individual factors (perceived usefulness and experience); 3. Demographic factors (gender, age, academic qualification); 4. Social factors (peers and social networks).

Interesting outcomes are done by Yusof et al. (2007). The author identified inter-related critical adoption factors of HIT, including technology, human, quality of organizational information, system use, and organizational environment. Whereas a Canadian review of EMR adoption in primary care, looking at many articles from different countries, found that socio-technical

factors are the most important factors that affect successful implementation (Ludwick & Doucette, 2009).

Jha et al. (2008) evaluate the process of HIT adoption in seven industrialized nations (United States, Canada, United Kingdom, Germany, Netherlands, Australia, and New Zealand); these nations have a high level of ambulatory (outpatient) EHR adoption, but delayed regard inpatient and health information exchange (HIE). The study provides two lessons. The former, key factors that have been increasing EHR adoption in these nations include; financial factors, incentives of care quality, and requiring that computers be used for key administrative tasks. The latter; without re-aligning financial incentives, EHR adoption in hospitals will lag.

Salameh et al. (2019) evaluate nurses' attitudes and acceptance toward EHRs (computer-based documentation) in three Palestinian governmental hospitals. The study reveals that the positive attitude of nurses is related to many factors. These factors are working years (more working years means they more experienced paper-based records difficulties), besides higher degrees (nurses with higher degrees have more positive attitudes). Positive attitude toward computerization results from paper-based documentation difficulties.

2.3 Barriers of Health Information Technology (HIT) Adoption and Implementation.

According to Ludwick and Doucette (2009), barriers are negatively influencing interaction among HCPs and patients, also influence patient care, safety, and privacy, besides patient reservation and cost. It also affects the required time of implementation.

Despite HIT system effectiveness, the health providers' and users' concerns are increasing in the U.S. (Zayas-Caban & White, 2020). The most important concerns of HIT are related to safety and cost concerns. Regarding safety concerns, there are 50,000–100,000 annual U.S. deaths caused by medical errors (Kohn et al., 2001) also in the U.S. annually there are 100000 deaths because of preventable errors (Barach & Small, 2000). Wherein the UK, there are 850000 incidents related to patient safety that caused 25000 deaths (Teasdale et al., 2002). Regarding costing concerns in 2016, the U.S. spent 3.3\$ Trillion annually on the healthcare sector (Centers for Medicare & Medicaid Services, 2018b).

The main barriers of EHR can be represented through the cost of executing such a system is high ranges somewhere "between \$15,000 and \$70,000" (Fleming et al., 2011). As well as the cost of maintenance and repairing hardware such as computers, screens, printers. In addition, assuring ongoing features and solves stuck problems (Ajami & Bagheri-Tadi, 2012).

The most significant drawbacks of such a system are privacy and security concerns related to the electronic transfer of medical information from one setting to another. Although EHR can be financially beneficial, the cost of implementing such systems and ongoing maintenance of hardware, besides the cost of ongoing updates and software, can be a burden (Salameh et al., 2019). The most important barriers that cannot be overcome easily; the cost of implementation, transfer of data to a new system, system developers facing financial problems, provider resistance, security, and privacy concerns (Bates et al., 2003).

Despite the HIT rate exceeding 90%, but dissatisfaction regarding the HIT effects on patients and workflow is very high. Where clinicians describe HIT as disruptive and inefficient, besides, there is a lot of studies that provide evidence that HIT usage does not meet expected benefits (Greenhalgh & Stones, 2010).

According to Kimble and Massoud (2021), and Pagliari et al. (2005), the adoption rate of HIS applications is still low. Besides, HCPs resistance toward electronic records is a common thing in both developing and developed countries. It takes time till HCPs understand the real reasons for the shift and till they modify their behavior and attitude toward computerization. Therefore, understanding the innovation and the healthcare challenges will form a better understanding and long-lasting innovative and improved health systems. According to Anderson (1999), and Bleich and Slack (2010), there is still limited use of electronic-based records and heavy

dependence on paper-based records in the public and private sector. In the U.S., only 50% of primary care providers use EMR. In the U.S., 83% of ambulatory care (outpatient) and 90% of hospitals do not have EMR. Paper-Based Health Record (PBHR) is still used in public and private health care organizations in many developing countries despite it reduce the effectiveness and efficiency because the medical records contain a large set of diverse data where it's hard to manage, store and organize (Setiawan et al., 2014; McDonald et al., 2014).

The health system is a complex organizational system and complicated environment, which is a diverse and rich-information system that contains ongoing challenges. Thus, it is not easy to introduce new technology to such a complex and dynamic system due to complicated inter-related social and technical issues (Berg, 2001; Johnson & Turley, 2006).

According to several scholars, the analysis of HIT incidents is related to many issues, such as input, technical factors, human factors, and information transfer, which resulting healthcare errors (Koppel et al., 2005; Magrabi et al., 2012; Westbrook et al., 2012). According to Kelly and Young (2012), the main challenges of innovation are represented through financial issues, the health status of the population, where people live longer with many diseases, which increase demands and public expectations, in addition, to accept failure as part of innovation culture.

Resistance hinders the successful implementation of such systems or it would take more time till a new process is modified or delivered. People in

nature resist change; therefore, resistance by health providers to accept and use EMR is considered as one of the major barriers that restrict HIS adoption and successful implementation; therefore, HIS and EMR integration should be considered as a change project. Change management quality plays a critical role in effective implementation (Boonstra & Broekhuis, 2010; Thakur et al., 2012; Ajami & Bagheri-Tadi, 2012).

HCPs resist such a system, especially when they shift to computerization. In the beginning, it seemed difficult, but when HCPs practiced EHR, they recognized the positive effects of such systems. They realized that electronic-based records are easier than paper-based records (Ajami & Bagheri-Tadi, 2012). According to Ajzen (1991), employee resistance will affect expected goals and benefits. People, by nature, will resist any change until they are convinced about change direct benefits and realize the purpose of change.

According to local HCPs, human barriers (negative beliefs, behavior, and attitude of HCPs) are the most spread barriers that delay HIS and EMR adoption and implementation (Altuwaijri et al., 2011). Yarbrough and Smith (2007) conclude that users' resistance is one of the most important barriers that delay and restrict EMR implementation, besides privacy and security concerns and financial issues (financial incentives). The study also mentions the acceptance barriers, including the organizational issues related to training, resources, management, size, and current norms (collaborative,

supportive, and focus on teamwork) and system issues related to flexibility, reliability, and dependability.

Gesulga et al. (2017) identify core barriers (56 barriers). The study reveals two primary barriers. The former is that people resources (user resistance, fear of change, and lack of needed skills, awareness, education, and training) whereas the latter is that procedure resources such as concern for ROI, lack of funding, and execution matters. The study classifies barriers according to information system resources - people, hardware, software, data, network, and procedure (Gagnon et al., 2016).

The inter-related human, technological and organizational factors play a critical role in HIT implementation. The study lists key barriers of HIT implementation, which includes design, time, cost, technical, resource validity, besides legal, privacy, and security concerns in addition to HCP and patient interaction, applicability on the patient, changes in duties, besides attitude toward electronic system (Gagnon et al., 2010). In addition, May et al. (2007) found that technology design, HCPs interactions, besides organizational factors, are included important barriers such as cost, insufficient information management, the rigidity of the system, and lack of testing.

Ludwick and Doucette (2009) list barriers that are related to end-user, which can be represented through, 1. User concern (e.g., changes in work practices) this type of barrier may lead to resistance toward HIT adoption; if users perceived that change is mandatory, then the resistance will be strong and

high; 2. User needs and perspectives should be considered, such as user involvement in design and implementation; 3. User previous experience with a computer can affect adoption.

Jung et al. (2020) qualitatively analyze the current EHR system in Russian Far East. The study introduces several barriers to the nationwide implementation of EHRs in the Russian Far East, including technical issues regarding inadequate system development, poor adoption of standard terminology, poor infrastructure, and poor functionality. In addition to user issues regarding the resistance of the new system (platform) besides lack of interactions between governmental and hospital.

2.3.1 Barriers of Health Information Technology (HIT) Adoption and Implementation in Developing countries (Middle East)

In developing countries, there is still a gap between the planning of introducing such electronic systems and successfully executing and operating to reach out to expected goals. Where this gap may not result from technology, it may lack in providing technical support pre and post-execution of electronic systems, besides, cost of shifting to electronic systems as well as financial matters (Sapirie, 2000; Amatayakul, 2010).

Khalifa (2013) has identified and analyzed the most important factors that affect EMR adoption and implantation according to HCP's perspectives. The study target was EMR of Saudi Arabian hospitals. The study listed six categories of most important barriers; 1. Human (HCPs); 2. Professional

(working at the hospital); 3. Technical (IT and hardware); 4. Organizational (hospital management); 5. Financial (money); and 6. Legal and regulatory barriers (laws and policies). Two major categories of challenges are represented via human barriers related to HCPs (beliefs, behaviors, and attitudes); besides financial barriers related to funding.

In the Palestinian case, the most significant barriers to Avicenna HIS system implementation are relevant to the funding issue (renewing maintenance contract with DataSel). When the support contract of DC had expired on September 30, 2015, between Dimensions and USAID, as a result, the Avicenna software lost maintenance; no bug fixed or received any support from the Dimensions/DataSel. The Flagship project ended in September 2014. Since the project expired all support toward Avicenna stopped (HEALTH INFORMATION SYSTEM (HIS) ASSESSMENT REPORT, 2015).

Hayajneh and Zaghloul (2012) list main barriers and challenges that restrict and delay the successful and effective HIT implementation in Arab countries hospitals (ACH) are related to financial resources, bureaucracy, management, competency of using IT by hospital crew, qualifications of IT department, besides HIT knowledge of hospital administrators.

Alsadan et al. (2015) identify the current status of HIT in Arab countries, besides identifying barriers to HIT implementation. The study found that the lack of financial resources besides professional incompetency are the main reasons for delaying HIT implementation.

According to Alsadan et al. (2015) and Khalifa (2013), public hospitals suffer from a lack of professional use of IT while private hospitals do not have adequate funds for HIT implementation. Arab countries need to establish effective strategic plans for successful and effective HIT implementation and to overcome the financial and cultural barriers. Governmental hospitals have more complaints and concerns than private hospitals, in terms of technical and organizational factors. In fact, there is a lack of experience to execute EMR, besides the used systems are old.

The main obstacles facing Palestinian health centers are the availability and sustainability of computers; many health centers do not have computerized systems. The study concludes that EHR should be adopted as a national shared system among all Palestinian medical institutions, motivate medical crew through incentive programs with effective ongoing training through effective plans. In addition, integrate Information and Communications Technology tools (ICT), as well as the Palestinian research centers, should pay more attention to such studies besides assessing the infrastructure and performance continuously (Sa'id, 2013).

According to Shawahna (2019, p.17), a consensus study about current EHRs missing important features with embedded CDSSs that are used in Palestinian public hospitals. The consensus was achieved on "(1) System should be able to record and keep admission and discharge information of the patient, (2) Items related to the patient's identity and body characteristics, (3) Features need to include prompts and abilities to make entries related to

patient assessment. (4) System should provide prompts to specify doses of the medications. (5) Items related to alerts provided by the system after checking prescriptions, (6) Items related to the quality of alerts and warnings provided by the system".

In Palestine, healthcare services are delivered through private and public sectors, besides United Nations Relief and Works Agency for Palestine Refugees (UNRWA). Palestinian Ministry of Health linked all public hospitals in West Bank through shared HIS by using Avicenna electronic system. Avicenna is only used in governmental hospitals, where it is not linked with other sectors, such as private hospitals. Therefore, the medical information and records of the patient are not shared across different sectors (Shawahna et al., 2019).

In Palestinian healthcare, the used IT infrastructure is weak where it affects the internal and external data sharing; this weakness affects utilizing opportunities. In addition, public health providers in Palestine have neither in-house system development nor know about the benefits of using cloud architectures in healthcare systems. Therefore, the study concludes there should be more training on the health management system. Furthermore, there is an apparent shortage of employees who work on system development, and there should be more support for cloud computing applications (Abdoh & Salman, 2019).

2.4 Benefits of Health Information Technology (HIT)

Health Information Technology (HIT) has a lot of notable benefits that lead to a better quality of provided care and service, as well as a reduction in medication errors. The benefits of electronic records are beneficial for HCPs groups too, where electronic records facilitate the documentation process for the nursing department. For nurses, electronic records enable all medical information to be documented into an electronic version that is long-lasting. In addition, such records benefit the nursing department through overcoming handwriting issues, such as misunderstanding of physician handwritten reports (Johnson et al., 2016; Mohammadi et al., 2016).

Electronic records facilitate nursing duties and enhance provided medical services for a patient, which increases patient safety, where patient safety is defined as avoiding harmful/injuries from the care that is intended to help patients (Kohn et al., 2001). In addition, through such records, the nurse can share patient medical record between different hospitals settings, which lead to a smooth process of sharing patient medical information, which means a flexible process of access to patient records (Coffey et al., 2015; Stokowski, 2013; Yontz et al., 2015).

Electronic records' main advantages are represented by providing accurate diagnostic, cost-effectiveness, time-efficiency, effort-saving, keeping records, reduction of medication errors, documentation, usability, and accessibility to patient records remotely besides the physicians can restore, modify, arrange and display the data quickly. Whereas the main

disadvantages of paper-based records are represented through the lack of privacy and security, takes large storage space and require a health insurance company to prevent fraud, unorganized records, duplication, lack of accuracy, consume a lot of time and effort, especially for patients with many chronic conditions, beside inaccessibility when needed; inaccessibility remotely and inflexible data storage format (Hersh, 1995).

On the other hand, Adetoyi and Raji (2020) conclude that EHRs implementation in developing countries will advance healthcare services, information, treatment, decision-making support, accuracy, effectiveness, efficiency, cost-effectiveness, care quality, and integration.

According to Menachemi and Collum (2011), the transition process from paper-based records to electronic-based records reduced the cost of used papers. Besides, it saves storage spaces. In addition, it reduced the cost of care, in terms of laboratory tests, radiology images, and diagnoses in which all received treatments, drugs, and diagnoses are documented in the electronic patient record where prevent duplication or repeat tests.

HIT informatics provides efficient and accurate treatment while saving time, cost, and effort, where a physician can remotely access the medical history records and vital information, its aim to provide the best treatment at a reasonable price during a short time remotely (Kloud System, 2020).

According to Shawahna (2019), EHRs with embedded clinical decision support systems (CDSSs) provide positive effects represented through

delivering a better quality of provided service and care; it saves time (time-efficiency) and cost (cost-effectiveness). Also, it is safer in terms of keeping medical records. In addition, it reduces medication errors and increases guidelines commitment, and it enhances communication among HCPs.

Through paper-based records, key HCPs cannot obtain the needed clinical information quickly; therefore, paper-based charts do not save HCPs time and effort, besides it does not support clinical decisions effectively as well as redundancy and inefficiency of provided service (Agarwal et al., 2010; Griffon et al., 2017; Shemilt et al., 2017). Moreover, despite paper-based chart is cost-effective and do not require time for extensive training and learning but it leads to medication errors besides errors regard prescribing, managing, and dispensing drugs (McHugh and Barlow 2010; Stirman et al., 2012). Medication errors lead to almost 12,000 deaths per year in the NHS, besides threatening people's safety and lives as well as leading to extra healthcare expenses (Sutherland et al., 2020).

2.5 Facilitators of Health Information Technology (HIT)

According to May et al. (2007), Jung et al. (2020), and Gagnon et al. (2010) facilitator of HIT implementation includes system flexibility, ease of use, organizational readiness, a good relationship between HCPs and patient. In addition to governmental strategic plans, systems managed centrally, health information exchange (HIE), willingness to use new functions, and well-

established work processes. Besides, perceived benefits, system utility, positive effects of the system, training and support user, involve the user in design, besides management.

Yusof et al. (2007) mention the success factors, which include access to information, ongoing support and training users, leadership, technical support, system usefulness, response time, user involvement, clarity of system purpose, user knowledge, experience, and skills in addition to internal interaction.

Antwi et al. (2014) reveal motivations for adoption and use medical technology in Ghanaian governmental hospitals related to facilitating conditions (the persuasive user that technical support exists for any help), besides social impact (influence of other users in the workplace), as well as anxiety, self-efficacy, attitude toward using technology, effort and performance expectation.

2.5.1 Solutions and Issues for Improving Health Information System Adoption and Implementation

Some authors, Bates et al. (2003. p.8), have driven further recommendation for many solutions to adopt EMR, such as “facilitating EMRs adoption in primary care; a coordinating infrastructure should be established with \$20,000,000 initial funding, adopt large national pilot studies. In addition to specific practices and policies (zero-interest loans, increase repaying for

EMR/EP users, electronic decision support), as well as a public-private partnership to encourage EMR adoption in primary care”.

Talukder (2012) encourages an organization to design more effective training, besides educational programs to motivate employees to adopt innovation effectively as well as to implement and manage innovation. In addition, the management should consider social, organizational, demographic, and individual factors. In addition, peers should support and encourage individuals to increase the innovation adoption rate and master innovation skills.

Young (2017) indicates that healthcare should depend on ongoing innovation through providing novel ideas such as innovative culture that motivates the employee to be innovative; innovative leadership that motivates and guide employee toward adopting innovation to reduce resistance; innovative changes which combine between the medical challenges and technical, innovative training, incentive programs besides understanding that failure is part of innovation. Innovative technology and innovative strategy should add value to achieve sustainability, adapt with evolution, and ensure high-quality care.

According to Suykerbuyk et al. (2018), Gupta & Murtaza.(2009), and Leeming et al. (2019), the successful implementation of EHR requires ongoing and strong interaction among physicians, pharmacists, nurses, and patients for better health delivery. In addition, the user views and perceptions

should be taken into consideration and integrated into the early stage to satisfy their needs for involving the end-user and health provider is a critical issue for synergy and interaction to reduce resistance.

The successful transition from written to electronic records provides many benefits. Still, it requires many procedures such as ongoing improvement, accurate evaluation, training the required technical skills, and providing incentive programs; however, U.S. 38 \$ trillion is paid on such programs to adopt certified EHR (Centers for Medicare & Medicaid Services, 2018a). The transition also depends on many aspects such as internet, speed of connection in provider office (Shortliffe, 1999), availability, cost and capacity of computers/digital devices (Shah, 2001), software and applications flexibility (Weed, 1968; Shah, 2001).

Hayajneh and Zaghloul (2012) mention that HIT implementation challenges need issues regarding long and short-term policies by providing sufficient funding to hospitals. Besides, hospital crew needs to receive adequate training to enhance their knowledge, technical skills, and awareness toward this kind of system to reduce resistance.

According to Ludwick and Doucette (2009), the following Issues should be considered for effective HIT execution. First, when the usability of electronic system increase then the adoption rate will increase too. Second, training can affect adoption; training should be sufficient and effective pre-and post-adoption. Third, productivity improvements decrease directly after

implementation, but when users get used to and get familiar with the system, productivity improvements will increase. Fourth, Cost concerns are a common barrier to adoption. Fifth, Governmental financial aids result in facilitating adoption. Sixth, adopting such a system enhances and improves patient safety, but initial adverse effects on patient safety still exist because of socio-technical matters; strong management and suitable training can reduce these matters.

2.6 Applications of Health Information System (HIS)

Research on HIS has a long tradition. HIS includes many applications such as Electronic Prescription (EP), Electronic Medical Record (EMR), Electronic Health Record (EHR), Electronic Patient Record (EPR), Computerized Patient Record (CPR), Health Information System (HIS). All the alluded have the same goal which is saving people's lives through providing high-quality care (Lærum, 2004).

HIT applications ensure accuracy and safety of provided cure, as well as medical decision support beside it allows for accurate treatment at an affordable price during a short time remotely (Kloud System, 2020); therefore, U.S. budgeted 27\$ billion to adopt HIT (Carter, 2015).

2.6.1 Electronic Medical Record (EMR) and Electronic Health Record (HER)

Electronic Medical Record (EMR) contains the basic medical information limited to one hospital. Therefore, EMR has multiple advantages such as saving time, effort, costs, storage space, besides accurate, and organized data. However, EMR also has many negative aspects such as technical complexity cost. It takes 44 minutes to enter data and orders electronically per day (Bates et al., 1994; Tierney et al., 1993). According to Bates et al. (1999) and Gandhi et al. (2000) EMR most important benefits are represented through availability, usability, remote accessibility, legible, practical, automation, computerization, quick review (sense of patient problem), as well as EP improve safety, where medication error reduced 80%. Also, it leads to more interaction between provider and patient (outpatient), monitoring and tracking abnormal results with follow-up, in addition to sharing medical information between carer and patient.

Widespread adoption of EMR is currently a national priority. The main goal of using EMR is to increase the quality of medical records and patients' health care and improve the medical system so that the U.S. budgeted 27\$ billion to adopt HIT. In 30 years, the EMR has enormously changed the medical practice. These changes improved medical performance and used digital technologies within hospitals and clinics to increase quality and accuracy. However, EMR depends on its interface, where it is the programmer's responsibility (Carter, 2015).

Electronic Health Record (EHR) contains more detailed intensive medical information shared among multiple medical institutions. All departments and providers should be linked together through an EHR system for easy exchange, sharing, and interaction of test results and orders (Gupta & Murtaza., 2009; Leeming et al., 2019). Also, EHRs manage the physician and patient time where it enables feedback from patients and is followed by the physician (El-Yafouri & Klieb, 2014). Using EHRs enable multiple health providers to access, assess, manage, display the user-health record remotely, where the physicians can use it multiple time (reusable) without duplication (Song et al., 2015; Ved et al., 2011).

EHR stores the health informatics into an electronic version via computer where all authorized users can share it for efficient and integrated health care. Such records include the basic and intensive information about the user health, such: blood type, family history, allergies, drugs list, genotype, immunization, medical history, made surgeries, drug interactions, and physician notes, results of tests. It also involves the physical, psychological, mental and behavior during all hospital consults, visit, and admission pre and post-period (Rimpilainen, 2015).

According to Sinsky et al. (2016) despite the positive aspect of EHRs, it also has many negative aspects, such as that users spend a lot of time in the office on the desk. Moreover, patients complain about how they struggle when electronically accessing medical records or information.

2.6.2 Electronic Prescribing (EP) and Computerized Provider Order Entry (CPOE)

Electronic Prescribing (EP) is an important HIS application because it ensures accurate diagnostic and reduces medication and prescription errors not to mention that it increases medication safety. It refers to pharmacists and drugs (Anton, 2004). Medical errors affect and threaten people's lives. Medication errors are a significant type of medical errors in the U.S.. Annually, there are 100000 deaths because of preventable errors (Barach & Small, 2000). In 1999 in the U.S. annually, 7000 deaths were caused by medication errors (Kohn et al., 2001). EP is supported by CPOE, where it enhances medication decision-making (Ammenwerth et al., 2008).

There is still a lack of using the Computerized Physician Order Entry system (CPOE) in the U.S. and Western countries. The perception of the prescriber and crew toward executing the CPOE system is essential. The result showed that the transition from paper-based prescription to electronic-based prescription received a lot of attention. The prescriber and staff adopted this transition because of its positive effects. The EP and CPOE can improve patient safety and the quality of provided care. It is evident in ambulatory settings (outpatient) where there is communication between patient and pharmacy, where computers and digital devices exist in laboratories and examination rooms, and availability of remote access (Devine et al., 2010).

By 2000 CPOE was developed to reduce medication errors by 80% (medication safety) and reduce paper-based records, but it has many negative issues; fatality increased, delayed care, and less time bedside (Carter, 2015).

2.6.3 Electronic Patient Record (EPR) and Patient Health Record (PHR)

Informative health revolution was spearheaded in 1980 by pioneers in primary care who worked in an appropriate environment and they successfully implemented the electronic patient record (EPR). Moving away from handwritten and typed paper records. EPR has successfully saved costs and improved efficiency and high-quality audits. In addition, efficient EPR has many benefits, such: fast and reliable access to patient data (Peckham, 2016).

Patient Health Record (PHR) is the solution for the patient who has many concerns and visits multiple physicians and pharmacists. This record provides all patient medical information available for physicians and patients, both can access it anytime remotely. PHR is not the same as EHR because PHR includes basic health information, while EHR provides more intensive information because it uses health providers to store the visit notes and tests results. PHR that is tied to EHR is called a patient portal. However, PHR has many negative aspects. For example, a few hospitals, health providers, and insurance companies send information electronically, and the patient should update the record manually (Mayo Clinic, 2020).

2.7 Conclusion

Gesulga et al. (2017) recommend examining barriers of EHRs in detail and how to address these barriers. In addition, Cresswell and Sheikh (2013)

indicate there is a need for a conceptual framework that illustrates the process of HIT adoption and implementation. On the other hand, Salameh et al. (2019) recommend exploring the main factors that affect attitudes and acceptance toward computerization, particularly in developing countries. Collins and Dempsey (2019) recommend examining HIT adoption based on those involved in improving the healthcare innovation process. Based on their perspectives, skills, and experiences to form an inclusive framework. On the other hand, Andargoli et al. (2017) emphasize the shift from a technical perspective to inclusive and different perspectives when evaluating and studying HIT adoption and implementation by considering political, social, economic, cultural, and organizational factors to form inclusive understanding toward computerization.

2.7.1 Developing Countries Regarding HIT studies

Regarding developing countries in the Middle East, Hayajneh and Zaghloul (2012) list the main barriers and challenges that restrict and delay the successful and effective HIT implementation in Arab countries' hospitals (ACHs). On the other hand, Khalifa (2013) has identified and analyzed the most important factors that affect EMR adoption and implantation according to HCP's perspectives in Saudi Arabian hospitals. On the other hand, Salameh et al. (2019) focused on the attitude and acceptance of nursing departments toward EHRs in Palestinian governmental hospitals. Otherwise, Abdoh and Salman (2019) mention that the used IT infrastructure is weak,

besides lack of awareness toward cloud architectures, and development of in-house system matters in Palestinian healthcare centers. According to Shawahna (2019) consensus study about the current Avicenna system used in Palestinian public hospitals. A consensus was achieved on critical missing features of the Avicenna system with embedded CDSSs.

A closer look at the literature on EHRs, however, reveals a number of gaps and shortcomings. Based on previous academic studies, there are no published studies regarding key factors, including barriers, facilitators, and theoretical frameworks that qualitatively investigate the current status of EHRs adoption and implementation across Palestinian governmental hospitals. Although studies have been conducted by many authors, this problem is still insufficiently explored.

Chapter Three

Methodology

This chapter presents the research tools and methods that the researcher used to collect, analyze, and interpret the data. In addition, it introduces a general overview of methodology definition and research approaches. Later, it illustrates philosophical assumptions of qualitative research, besides the validity and reliability of the study, in addition to the research method.

3.1 Overview

Research methodology is a set of systematic steps that researchers usually commit and follow while researching to solve the research problem (Rajasekar et al., 2006). The researcher should be careful when deciding which methodology to follow because the followed methodology should fit and comply with the research nature, objectives, and questions. Moreover, the appropriate methodology will lead to needed output by answering the research questions effectively. Therefore, the researcher should decide which approach to follow based on the nature of the research problem: the quantitative or qualitative approach or mixed methods (Williams, 2011).

3.2 Philosophical Assumptions of Qualitative Research

Philosophy can be defined as “the questioning of basic fundamental concepts and the need to embrace a meaningful understanding of a particular field” (Burke, 2007, p. 476). The philosophy of qualitative research is "interpretive,

humanistic, and naturalistic". The qualitative researchers believe that the "truth is both complex and dynamic and can be found only by studying persons as they interact with and within their sociohistorical settings" (Creswell, 2007, p. 89).

The research paradigm helps the researcher in identifying the research philosophy (Alghamdi & Li, 2013) whereas the research philosophy is the framework that guides the investigator to conduct the study (Collis & Hussey, 2014). The researcher should adopt the appropriate philosophy because it's pretty important particularly for methodology. Thus, the philosophical paradigm is very important in research as it is the "basic belief system or world view that guides the investigation" (Guba & Lincoln, 1982, p. 105).

Given the nature of the research, undertaking a qualitative approach to understanding key factors that affect EHRs adoption within the hospitals is found to be the appropriate strategy. The researcher chose an inductive approach to collect the needed data to answer the research questions effectively and establish a framework to identify the restricting and enabling factors that influence EHRs adoption and implementation in the Palestinian healthcare sector from HCPs' perspective. The researcher adopts the qualitative approach because it is the most suitable means for such exploratory research to achieve the research objectives and answer the research questions effectively. In addition, such a method allows the researcher to directly obtain information and interact in person with HCPs

and non-clinical groups. They are an integral part of healthcare practices. This direct engagement and dialogue with interviewees enable the researcher to understand and realize the research problem in reality. The researcher interacted with health workers through in-person interviews and open-ended questions. Each interview took from 20 to 35 minutes. The time includes writing down notes and recording all the twenty-six interviews. The aforementioned interviews were transcribed then analyzed through the Maxqda software program.

3.3 Inductive (Qualitative) and Deductive (Quantitative) Research Approach

Inductive research is mainly associated with qualitative research to develop/generate hypotheses or theories. In qualitative research, the researcher collects and analyzes non-numerical data (qualitative data). Such an approach focuses on a depth understanding of the meanings of humans, situations, and events in social reality (Harré, 1972). Therefore, such studies rely on in-depth interviews, focus groups, systematic review, grounded theory, and observations to obtain subjective facts (Polit & Beck, 2008). The inductive study aims to gain a rich understanding of subjective perspectives (Julmi, 2020) through answers to the “how”, “why” and “what” questions (Hussey & Hussey, 1997; Alhamdani, 2016). Qualitative research is related to exploratory and interpretative studies and more involved with human and social science to develop a rich and depth understanding (Myers, 2011).

Deductive research, on the other hand, is connected with a quantitative approach (objective approach) and aims to test a hypothesis or theory that has already been developed rather than exploring. In addition, to establish facts and make predictions (Alhamdani, 2016; Nykiel, 2007). Quantitative analysis (statistics-based) is usually related to numbers and statistical data that researchers collect and analyze to support the research hypothesis (Hussey & Hussey, 1997). Thus, such research is more interested in “how much”, “how often” and “how many” questions through using the quantitative methods include surveys and questionnaires, where such approach is more involved with equations, numerical, mathematical modeling, and statistical analysis for decision making (Myers, 2011; Rasinger, 2008).

Accordingly, inductive studies aim to build theories whereas deductive studies aim to test existing theories (Shahwan, 2015).

3.4 Reliability and Validity

Reliability means how the used measure is consistent whereas validity means how the used measure is accurate. In addition, reliability means repeatability, having the same test result from each time the test is repeated at two different times assuming what is being measured has not changed. The test is valid when it measures what it is supposed to measure (Shahwan, 2015). Reliability and validity are essential qualities that should be mentioned in qualitative and quantitative research to evaluate the research quality and

credibility. Reliability and validity can confirm if the research findings are credible and trustworthy or not (Thakur, 2021). Validity refers to the “evidence that the instrument, technique, or process used to measure a concept does indeed measure the intended concept” (Fan & Yan, 2010, p. 447). It ensures that the designed research questions actually measure the concepts that should be measured (Shahwan, 2015).

3.4.1 Reliability

The researcher should ensure the collected data's accuracy in terms of form and context especially when the data is extracted from original sources and that is done through ongoing comparison which is one of the triangulation forms (George & Apter, 2004). There are multiple suggestions to ensure the reliability of qualitative studies, such as clear presentation of research findings, “limit the number of codes, and do not sacrifice relevance or meaning for reliability, besides, clear physical organization of texts, codebooks, codes, and coder” (MacQueen et al., 1998, pp: 19).

According to Silverman (2005) to enhance reliability, the researcher should tape-record all in-person interviews, provide a detailed transcript of recorded interviews, and provide a long summary of research data, in addition to, use fixed-choice answers.

To make sense of qualitative data, the researcher should code interviews in which coding is an integral part of qualitative data analysis (DeCuir-Gunby, 2011). Using a codebook in inductive studies is an initial and critical step of

the analysis process of interviews (Fereday & Muir-Cochrane, 2006). Systematic coding is a common technique in qualitative analysis because the codes are the foundation of building a theory or model (Strauss & Corbin, 1990; Miles & Huberman, 1994). Experts of the qualitative methodology did not establish a globally agreed standard for coding procedures of interviews (Coffey & Atkinson, 1996). Therefore, there is no specific standard or procedure to follow when coding interviews.

The research established a codebook and quotes table of interviews data. The codebook of interviews was established through the Maxqda software. The codebook includes a list of focused and sub-codes, descriptions of used codes in addition to examples. Codebook enables ongoing tracking of how codes are being used to understand data well.

The researcher fully transcribed all recorded interviews in Microsoft Word. According to Saldana (2016), the recorded interviews lead to a deep, cognitive, and holistic understanding of each spoken sentence. Thus, Maxwell (2016) recommends researchers fully transcribe all recordings. According to FitzPatrick (2019), taking notes through the interview is not sufficient at all and cannot be employed as a primary source of data, thus there is should be "verbatim transcribing" of all interviews data which refer to analytic rigor which increase validity.

The validity and reliability in qualitative research are promoted by employing a moderator or using respondent validation or triangulation strategy and using tools such as Microsoft Excel and qualitative analysis

software such as NVIVO (Thakur, 2021). Therefore, all transcribed interviews were analyzed through a moderator (Maxqda analyst) through Maxqda software. Furthermore, respondents' validation was used to ensure validity and reliability. Hence, the researcher met the first seven participants and checked their answers which helped the researcher to modify multiple questions and add more detailed questions. At a later stage of the data collection process these, seven participants were interviewed again with the new list of updated questions.

The researcher has recorded all face-to-face interviews with the permission of the participants. Each interview lasted from 20 to 35 minutes in addition to taking notes. The researcher interviewed twenty-six health workers from clinical and non-clinical groups from different wards and different healthcare groups, including pharmacists, nurses, specialists, physicians, administrative staff, IT specialists, physiotherapists, and radiologists, as is illustrated in Table 3.1.

Table 3.1: Respondents Demographics

City	Palestinian Ministry of Health Hospitals	Respondents	Numbers Total=26
Jenin	Jenin Governmental Hospital	• Pharmacist	1
		• Pharmacy manager	1
		• physiotherapist (clinical)	1
		• Head of the physiotherapy department	1
		• Allied medical professions director	1
		• Administrative and financial director	1
		• Nursing manager	1
		• Computer Engineer	1
		• The general manager of the hospital is also a Pediatric physician (clinical)	1

			<ul style="list-style-type: none"> • Medial Manager of the hospital, also Internist physician (clinical) • Pediatric surgery specialist (clinical) 	
			<ul style="list-style-type: none"> • Emergency doctor (clinical) • Nurse in the emergency department (clinical) • Head of emergency department (clinical) • Radiologist (clinical) 	1 2 1 1
Ramallah	Palestine Complex (PMC)	Medical	<ul style="list-style-type: none"> • Radiologist technician (clinical) 	2
Tubas	Tubas Government Hospital	Turkish	<ul style="list-style-type: none"> • Ear, nose, and throat specialist (clinical) • Deputy the administrative and financial director 	1 1
Tulkarm	Thabet Governmental Hospital	Thabet	<ul style="list-style-type: none"> • Director of Statistical Department • Data entry • Director of central pharmacy 	1 1 1
Nablus	Rafidia Hospital	Surgical	<ul style="list-style-type: none"> • Pediatric surgery specialist (clinical) • Administrative and financial director • Networks engineer 	1 1 1

The six targeted governmental hospitals are supervised by the Palestinian Ministry of Health that includes Jenin Governmental Hospital, Rafidia Hospital, Nablus National Hospital, Palestine Medical Complex, Tubas Turkish Governmental Hospital, and Thabet Thabet Governmental Hospital. The content of questions is directly related to the content of research objectives and questions. All semi-structured interviews questions are open-ended questions. Appendix 3 displays interview questions that were conducted between January 11 and April 11, 2021. The researcher in-person clarified each question to all participants to form a better understanding of the question contents. The researcher also provided a paper for each participant that contains a general overview of research

objectives, as illustrated in Appendix 1. There is a variety of interview questions to cover all the possible pros and cons of the current status of EHRs from HCP's perspectives. Also, there is variety in the targeted groups of health workers.

3.4.2 Validity

The researcher divided the research sample into two groups which are clinical and non-clinical to reduce bias and enhance diversity. The research findings measure what it claims to measure, where the findings answer the research questions and clarify the research objectives. Findings can be generalized to the research population, which includes Palestinian governmental hospitals in West Bank.

The researcher follows the random sampling technique. The researcher randomly selected samples from each healthcare group. The researcher targets the HCPs and non-clinical staff where they are directly involved with EHRs challenges and benefits. Thus, these two groups are the most appropriate sample to investigate the barriers and facilitators of the current Avicenna HIS. According to FitzPatrick's (2019) recommendations for qualitative research validity, the appropriate sample in inductive studies. It is a purposeful sampling that targets the suitable people who respond to the research purpose results in enhancing the validity.

The researcher reached saturation where there is nothing new to be added to answers. All answers are almost the same especially when it comes to the

drawbacks and benefits of current EHRs. Thus, the researcher decided to stop when reaching 26 interviews because no new or unique information was added anymore. According to FitzPatrick (2019), when the researcher reaches saturation, then there is no need for more participants.

Qualitative research usually (textual) contains text and images. Therefore, it is not easy to measure validity apposite to quantitative analysis, where validity is measured through calculations. In the qualitative approach, validity is measured through triangulation where it includes four common forms (Hair et al., 2011), summarized as the following:

- Data triangulation: using multiple data sources while collecting data. For example, the qualitative approach uses an interview and quantitative approach using a questionnaire or using multiple sources of the same approach (interview, observation, and focus groups for qualitative approach).
- Theoretical triangulation: using multiple theories or hypotheses, or perspectives while testing the same phenomenon or problem.
- Investigator triangulation: using multiple Investigators, evaluators/researchers while collecting and analyzing data to reduce bias.
- Methodological triangulation: using multiple methods while collecting data in the same research (qualitative and quantitative) or using multiple methods of the same approach (interview, observation, and focus groups for qualitative approach).

Using at least one form of triangulation, to increase credibility and minimize bias, done through convergent findings from multiple data sources, multiple investigators, and multiple qualitative methods (Merriam, 2009; FitzPatrick, 2019; Hesse-Biber et al., 2011).

The researcher used multiple data sources, the primary and secondary sources. The researcher collected data directly from participants through in-person interviews, which refers to the primary source. Besides, the researcher collected information from published studies, online journals, and websites, which refers to secondary sources.

The researcher compared the related researcher's perspectives (findings) regarding factors, barriers, and facilitators affecting HIT innovation adoption and implementation with this research finding to confirm converge. According to compared related studies, most of the studies list the key factors regarding barriers and facilitators that affect HIT adoption and implementation in different settings based on different perspectives. Each study used a different categorization of factors and barriers. The contents of all compared studies almost converge. The researcher identified and categorized the key facilitators and barriers. The enabling factors considered facilitators that support EHRs implementation in addition to the restricting factors considered barriers that limit EHRs implementation. The emerging themes from data analysis shape a theoretical framework that maps out the key factors for adopting and implementing the EHR system across the Palestinian public hospitals.

3.5 Research Method

3.5.1 Research Methodology

The current study uses semi-structured face-to-face in-person interviews to collect qualitative data from different HCPs and non-clinical health workers in six Palestinian governmental hospitals located in five West Bank cities. The study follows the ground theory approach. Ground theory followed in inductive research to develop a theory based on collected and analyzed data.

In addition to addressing the study question, the researcher also develops a theoretical model that illustrates the main factors that affect innovation adoption and implementation (EHR) in Palestinian public hospitals based on HCPs and non-clinical groups' perspectives and experiences. An in-depth interviews methodology help researcher to form an inclusive understanding of EHRs adoption from HCPs and non-clinical groups' perspectives. They are directly involved with the electronic system (Avicenna).

3.5.2 The Used Methodology in HIT studies

As shown in Table 3.2, most HIT studies investigating major factors followed the systematic review, questionnaires, and mixed methods. Accordingly, the qualitative method (interviews) is not used much in such studies to explore factors from HCPs' perspectives.

Table 3.2: Overview of HIT Studies Regarding Methods

Author	Methodology	Objectives
Ajami and ArabChadegani (2013)	Non-systematic reviewed	Express barriers for adopting the EHRs by physicians.
Ayatollahi et al. (2014)	Survey	Barriers in the process of design and adoption of EHRs from the experts' point of view in Iran.
Boonstra and Broekhuis (2010)	Systematic literature review	Identify, categorize, and analyze barriers based on doctors' perceptions toward EMRs adoption to provide implementers with beneficial intervention options.
Cresswell and Sheikh (2013)	An interpretative and systematic review	Determine organizational issues in the implementation and adoption of HIT to provide an overview and extract potentially generalizable findings across settings.
Farzianpour et al. (2015)	Review research	Investigate factors that influence the EHR implementation.
Gagnon et al. (2010)	Systematic review	Investigating barriers and facilitators of HIT implementation.
Gesulga et al. (2017)	Structured review and meta-analysis of related literature	Identify Barriers to EHRs Implementation and Information Systems Resources.
Hayajneh and Zaghloul (2012)	Descriptive cross-sectional design	Identify and describe the main barriers to HIT adoption in ACHs.
Holden (2011)	Semi-structured interviews	Identify and describe facilitators and barriers to physicians' use of EHRs.

Jung et al. (2020)	Semi-structured interviews and questionnaire	Qualitatively analyzes the current EHRs in Russian Far East.
Khalifa (2013)	Questionnaires	Identify, categorize, and analyze barriers based on different HCPs toward EMRs adoption to provide suggestions on beneficial actions and options.
Kruse et al. (2016)	Systematic literature review	Assemble an updated and comprehensive list of adoption barriers of EHR systems in the United States.
Talukder (2012)	Questionnaires	Investigates the determinants of the adoption of technological innovation by individual employees within an organizational context in Australia.
Yusof et al. (2007)	Qualitative systematic review	Identifying the most important factors of HIS adoption and studying the adoption issue.

3.5.3 Research Tool

The researcher used face-to-face semi-structured interviews as a tool to collect the needed data. The interview and conversation with participants (via phone, email, or face-to-face) are some of the most critical revenue of data (Scott, 2009).

The researcher in-person asked the interviewees open-ended questions about innovation adoption and implementation (EHR) in public hospitals with two groups (clinical and non-clinical). The researcher conducted in-person

interviews with twenty-six HCPs and non-clinical groups from six different hospitals in five cities. Each interview took 20 to 35 minutes. The researcher recorded and transcribed all interviews. Appendix 1 displays interview questions that were conducted between January 11 and April 11, 2021. All twenty-six interviews were analyzed through the Maxqda software program.

3.5.4 Research Population

The Palestinian health system consists of four sectors; the Government health sector (The Palestinian Ministry of Health and Military Medical Services); United Nations Relief and Work Agency (UNRWA); Non-governmental organizations and the private sector. The number of MOH hospitals in the West Bank is 15 and 13 in the Gaza Strip (Ministry of Health, Health Annual Report, Palestine 2020, June 2021). The research population is fifteen governmental hospitals in the West Bank whereas the research sample size is six governmental hospitals in the West Bank.

The research targets the government health sector because all public hospitals in Palestine are linked together and use the same health information system (HIS). All Palestinian Ministry of health hospitals used standard electronic health records (EHRs), which are called Avicenna (Turkish software).

The generalization of a larger interested population is not the purpose of the in-depth interviews process (Dworkin, 2012). The researcher interviewed twenty-six health workers from clinical and non-clinical groups from a ward-based pharmacy, ward-based physicians, and ward-based nurses in addition to the non-clinical group. As clarified in Table 3.3.

Table 3.3: Basic Wards plus Non-clinical Groups

Ward-based nurses (Clinical)	Ward-based pharmacy (non- clinical)	Ward-based physicians (Clinical)	Non-clinical groups
Emergency nurse (2)	Deputy director of the central pharmacy (1)	Pediatric surgery specialist (2)	Administrative and Financial Director (2)
Head of emergency department (1)	Pharmacist (1)	Manager of Jenin Governmental Hospital, also a Pediatric physician (1)	Director of allied medical professions (1)
Emergency doctor (1)	Pharmacy Manager (1)	Medial Manager of Jenin Governmental Hospital, also Internist physician (1)	Computer Engineer(1)
Nursing manager (1)		Physiotherapist (1)	Director of Statistical Department (1)
		Head of the physiotherapy department (1)	Data entry (1)
		Ear, nose, and throat specialist (1)	Deputy the administrative and financial director (1)
		Radiologist technician (2)	Networks engineer (1)
		Pediatric surgery specialist (1)	

The sizes of hospitals ranged from 45 to 300 beds, 300 to 900 employees. All hospital ownerships return to PMOH. As displayed in Table 3.4

Table 3.4: Organizational Demographics.

PMOH Hospitals	Respondents	Ownership (All hospitals are governmental)	Beds (approximately)	Hospital crew (approximately)
Jenin Governmental Hospital	<ul style="list-style-type: none"> • Ward-based pharmacy • Ward-based physicians • Non-clinical groups 	Public hospital	300	500
Nablus National Hospital	<ul style="list-style-type: none"> • Ward-based nurse • Ward-based physicians 	Public hospital	66	300
Palestine Medical Complex	<ul style="list-style-type: none"> • Ward-based physicians 	Public hospital	250	900
Tubas Turkish Government Hospital	<ul style="list-style-type: none"> • Ward-based physicians • Non-clinical groups 	Public hospital	45	200
Thabet Thabet Governmental Hospital	<ul style="list-style-type: none"> • Non-clinical groups 	Public hospital	128	347
Rafidia Surgical Hospital	<ul style="list-style-type: none"> • Non-clinical groups • Ward-based physicians 	Public hospital	200	700

3.5.5 Research Sample

The used sample size in qualitative studies is less than in quantitative studies because qualitative studies are based on an in-depth understanding of a situation or phenomenon. Therefore, some qualitative research experts avoid the question of “how many” interviews “are enough” where there is inconsistency in what is suggested as a minimum. The current guidance calls for providing a single clear and consistent standard of studies that use GT and in-depth interviews (Dworkin, 2012).

There are arguments about the appropriate and right sample size of such an approach which scholars argue that saturation is the most important factor that researchers should take into account when thinking about inductive sample size (Mason, 2010). The question of “how many” in qualitative studies “it depends.” Numerous factors are said to be important, including “the quality of data, the scope of the study, the nature of the topic, the amount of useful information obtained from each participant, the use of shadowed data, and the qualitative method and study designed used” (Morse, 2000, p. 1).

According to Dworkin (2012), the journal (Springer Link) refused to quantify the sample size of qualitative studies. Therefore, the study concludes that a sufficient sample size is when it gets closer to reaching saturation and redundancy.

The moment the researcher reached saturation, the sampling stopped. According to Creswell (1998), the sample size that ranges from 20-30 interviews is considered sufficient. On the other hand, Patton (2002) points out that the thematic saturation is accomplished when the researcher completes the 20 interviews. Bertaux (1981) points out that “saturation of knowledge” is a better term than “theoretical saturation” since saturation is the problematic term (Guest et al., 2006; Mason 2010; Morse 2000). Bertaux (1981) indicates that the researcher will learn a lot during the first few interviews, such as 15 interviews, during the additional interviews the researcher will only confirm what has already been sensed. On the other hand, Guest et al. (2006) indicate that 12 interviews of a homogenous group are enough to reach needed saturation. Mason (2010) mentions that Ph.D. students stop sampling in qualitative interviews when the sample size is a multiple of ten rather than reaching saturation.

The researcher follows the random sampling technique, randomly selected samples from the research population which is fifteen governmental hospitals in West Bank. The researcher follows the convenient sampling method of six governmental hospitals in the West Bank. The researcher targets six public hospitals out of fifteen public hospitals because of the HCPs strike and COVID-19 closure. As well as the researcher deals with two groups, the clinical and non-clinical groups.

3.5.6 Sample size and population of HIT Studies

Regarding the sample size and population, Antwi et al. (2014) recommend increasing the sample size and targeting many hospitals when addressing facilitators. On the other hand, Jung et al. (2020) recommend increasing the number of participating hospitals to generalize findings in different healthcare settings. Also, Talukder (2012) recommends investigating the individual perspective in different settings. Salameh et al. (2019) recommend targeting many HCPs and non-clinical groups to address key factors that affect acceptance toward EHRs.

According to the previous studies, most HIT studies were done in a single hospital, and data was collected from a small number of participating hospitals or interviewees, besides interviewing particular HCPs groups; in addition, studies are limited to a single area. Therefore, there is a clear recommendation to target multiple HCPs and non-clinical groups from many hospitals from different areas and settings.

3.5.7 Ethics

Before conducting the interviews, the researchers explained the research objectives by providing a paper for each participant as illustrated in appendix 1. All participants voluntarily signed informed consent forms as illustrated in appendix 2. No participants refused to participate in an interview. With

the permission of the interviewees, the researcher recorded all interviews. All provided papers that clarified the research objectives and interview questions besides the consent forms were written in English and Arabic to ensure that all participants understood the research objectives and questions contents.

Chapter Four

Data analysis, Results, and Discussion

This chapter presents a qualitative analysis of the face-to-face semi-structured interviews that were conducted with 26 respondents of hospital staff, both clinical and non-clinical, from five governorates. In addition, it introduces the study findings and the key themes and sub-themes that emerged from the analysis to respond to research objectives and questions. After presenting the findings, a theoretical model has emerged from the data analysis that maps out the restricting and enabling factors that influence EHRs adoption and implementation across Palestinian public hospitals. Also, it introduces a discussion of findings.

Charmaz (1990, p.1162) points out that the main goal of GT and in-depth interviews is to create “categories from the data and then to analyze relationships between categories” while attending to how the “lived experience” of research participants can be understood.

4.1 Linkages Between Emerged Themes and Research Objectives

The primary research objectives include the following:

- A. Explore the ward-level implementation of EHRs and identify the role of HCPs and non-clinical groups in ensuring a uniform adoption of EHRs across public hospitals.
- B. Identify the enabling factors (facilitators) that support the EHRs adoption and implementation in public hospitals.
- C. Identify the restricting factors (barriers) that restrict the EHRs adoption and implementation in public hospitals.

The key themes that have emerged from the analysis include the following:

- 1. Processed implementation of the EHR system, with minor differences across hospitals.
- 2. Perceived facilitators support the adoption and implementation of the EHR system.
- 3. Major barriers limit the proper EHR system adoption and implementation.

Theme 1 responds to objective A. Explore the ward-level implementation of EHRs and identify the role of HCPs (Doctors, Pharmacists, and Nurses) in ensuring a uniform adoption of EHRs across the public hospitals.

Theme 2 responds to objective B. Identify the enabling factors (facilitators) that support the EHRs adoption and implementation in public hospitals.

Theme 3 responds to objective C. Identify the restricting factors (barriers) that restrict the EHRs adoption and implementation in public hospitals.

A theoretical framework has emerged from the data analysis that maps out the restricting and enabling factors that influence EHRs adoption and implementation across PMOH hospitals. All themes are interconnected and have logical relations, and together they present a theory that frames the enabling and restricting factors of EHRs adoption and implementation.

Figure 4.1 provides a visual explanation of three key themes (Third coding cycle/ aggregation) and ten sub-themes (Second coding cycle) in addition to significant concepts (First coding cycle/ open coding) that data reflect:

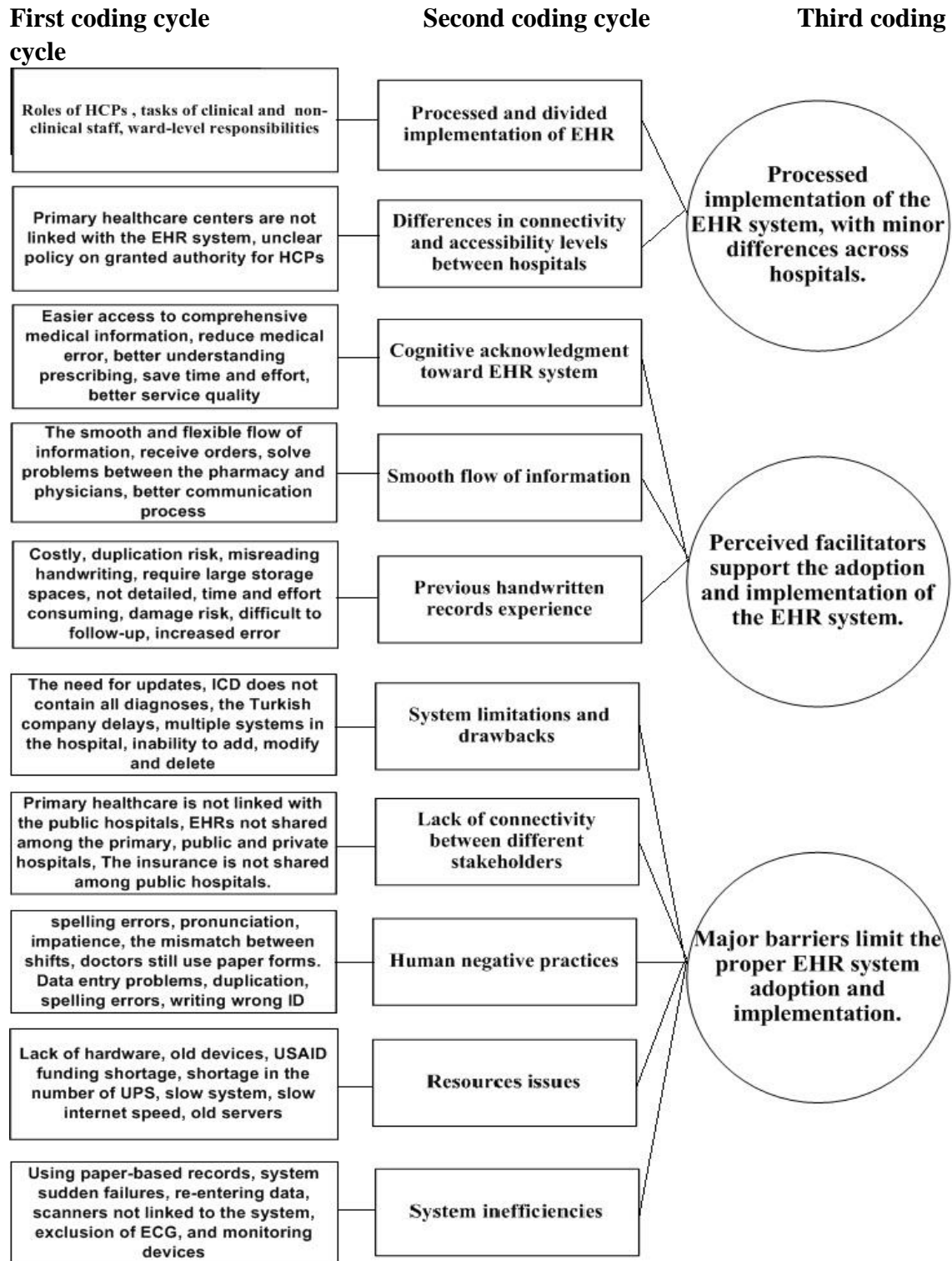


Figure 4.1: Data Structure Diagram

4.2 Results of Semi-Structured Interviews

4.2.1 Processed implementation of the EHR system, with minor differences across hospitals (Theme 1)

4.2.2 Processed and divided implementation of EHRs

The interviews with hospital staff showed how the implementation of the EHR system is done in a processed way, where tasks are divided between hospitals wards for both clinical and non-clinical staff. This part will only focus on each ward's responsibilities and common tasks across interviewed hospitals.

Ward-based physicians (Clinical group)

Doctors mainly use the EHR system to know the medical history of patients and any medical information related to the patient such as taking drugs, chronic diseases, medical notes, and medical reports. Through the EHR system, doctors can check tests results and medical images. The doctors enter the patient's medical information and write a drug prescription where the order is sent to the pharmacy. Doctors who chair management positions use the EHR system to monitor and assess employees' performance.

For doctors who are surgeons, they have additional engagement in the EHR system. Surgeons use the EHR system to book surgeries appointments, besides writing the surgery details, such as the patient condition before and after the surgery, surgery team information, type of surgery, and surgery

notes. In addition, surgeons use the EHR system to check any previous surgeries.

Two departments that are engaged with doctors also shared their experience: radiology and physiotherapy. Radiologists' primary use of the EHR system is to upload medical images to the system according to doctors' orders. Radiologists use the EHR system also to check, compare and retrieve previous medical images. In addition, radiologists see it as very useful to check the patient medical record to know any chronic, dangerous, or infectious diseases. The physiotherapy department receives orders from the specialist doctor that contains the prescribed treatment and the patient's electronic record. Physiotherapists also use the electronic record to know the patient's medical history, check patient radiology images, check other physiotherapist notes from previous shifts, and schedule appointments.

Ward-based nurses (clinical group)

Other HCP members is nurses. The main task of nurses is to write patients' vital signs, enter the provided drugs, enter the nursing notes and visit notes, besides write drugs for patients. The nurse should write in detail all the provided services, treatment, drugs, vital signs, medical notes, medical status, tests, besides duration of the patient's stay in the hospital, and medical records.

The emergency department uses EHRs to know the medical history of the patient. The nursing department can check the patient radiology images, laboratory test results and check previous surgeries from the electronic record. The nurse should document all the provided procedures in detail in the patient's health record.

Ward-based pharmacy (non-clinical group)

Pharmacists, as part of HCPs, play a critical role in the implementation of the EHR system.

Pharmacists receive drugs prescription that prescribed by doctors through the EHR system. Through their access to the patient's medical information, pharmacists use the EHR system to do quality control for prescribed drugs by ensuring and matching “between the physician prescription (visit) and follow-up orders (ordered drugs) to correct errors if found,” according to a pharmacist from Jenin. In addition, through the EHR system, the hospital pharmacy can monitor the taken prescribed drugs and it helps in tracking drug availability. Also, through it, pharmacists can know the “quantity of needed drugs and doses, besides the number of used drugs. Besides the number of available drugs, such as (cancer drugs and rheumatism drugs)” according to a deputy director of the central pharmacy from Tulkarm. This eventually supports the ordering process for needed drugs.

The inpatient pharmacist can check the physician notes/prescription from electronic records and check the nurse notes beside the stocks. Through such records, the inpatient pharmacist discovers the medication errors within physician notes, prescriptions, and orders.

Non-clinical group

Non-clinical staffs have their roles in the EHR system. IT department handles specific tasks within the EHR system. The first main task is controlling and establishing the user and department accounts and sections. In addition, the IT department applies the level of authority for the users within the system. The second main task is solving technical issues and bugs facing HCPs while using the EHR system besides providing technical support.

Administrative staff uses the EHR system to complete administrative work, such as the admission and discharge process, besides registering patients, checking patients' reservations, and checking their insurance matters. The system helps administration staff easily retrieve needed information, organize and manage information. It also facilitates the monitoring and tracking processes besides correcting errors. In addition, the EHRs help data entry and registration staff identify the required documents that the patient has to bring in the next visit.

Management level administrative staff uses the system to apply supervision over hospital staff and quality control to ensure the correctness of entered medical information. According to a statistician employee, the statistical department uses it to know the basic information of hospital patients in terms of numbers, to be able to prepare accurate reports that include the right and accurate numbers and statics of hospital patients/admissions.

The director of allied medical professions uses the electronic patient record to check the laboratory results, radiology images, physiotherapy reports as well as monitor and assess the employee's performance.

4.2.3 Differences in connectivity and accessibility levels between hospitals.

Two minor differences were spotted between Palestinian public hospitals on the implementation of the EHR system. The first difference is the linkages between the public hospital and primary healthcare. It was noted that only in Ramallah and Nablus governorates are the primary healthcare is linked with the public hospitals' EHR system. In contrast, the primary healthcare centers are not connected with the rest of the hospitals interviewed in this study.

Respondents in these governorates referred to many implications of the lack of these linkages. A key implication of this issue is that hospital staff cannot access the patient records of primary healthcare centers when they got

referred to these public hospitals. In addition, it leads to inaccurate diagnostic, where HCPs cannot know the physician's notes, visit notes, medical history, and medical reports. Furthermore, it leads to medication errors and duplication of prescriptions.

The second difference is with the granted authority to staff to access specific departments in the hospital. All Palestinian public hospitals are linked through HIS and have the same database. However, the level of the given and distributed authority to the medical staff to access different hospital department varies from one hospital to another. For example, a physiotherapist from Jenin shared his experience around the difference in accessibility between hospitals. He mentioned that when he used to work in Thabit Thabit hospital in Tulkarm, the accessibility was limited to specific hospital departments that are only relevant to his work. However, when he started working in Jenin, he could access all related departments and was not limited as before, which was valuable to his work.

This issue was described by a network engineer from Rafidia hospital in Nablus, who said that “there’s no clear and formal policy about the granted authority for HCP.” The level of authority and accessibility granted to hospital staff is determined by the general manager of each hospital—this

causes a reduction in the uniform adoption of the EHR system across hospitals.

4.3 Perceived facilitators support the adoption and implementation of the EHR system (Theme 2).

4.3.1 Cognitive Acknowledgment Toward EHR System

A key facilitator of the adoption of the EHR system is that the hospital staff interviewed in this study acknowledges the value and benefits of the system. All interviewed participants from different hospitals and occupations acknowledged the importance of EHR as it's an electronic record that contains basic medical information and the patient's medical history. In addition to that, this record, according to participants, includes medical images from the radiology department (X-ray, MRI, and CT/CAT), previous laboratory tests, vital signs, chronic diseases, and previous or appointed surgeries for the patient.

Granting easy access to the medical information of patients was of high value by most interviewed hospital staff. Clinical staff specifically stressed the usefulness of that, not only by allowing checking patients' images but also by comparing "the radiology images that return to any date/year. Additionally, it allows a quick and easy storage and retrieval of any medical

images” according to a medical imaging specialist in Nablus national hospital.

Moreover, some participants stressed how the medical documentation in the EHR systems is comprehensive, as the electronic records are “comprehensive records that include the medical history of patients, where it includes the visit notes, test results, physicians’ notes, allergies, surgeries, taken drugs, genetic diseases, chronic diseases, nursing notes, reports, diagnosis, and blood group,” [clinical staff – Nablus National Hospital].

These features of the EHR system were perceived as a way to enhance medical decisions and make them well informed by accurate information. Due to the easy access and comprehensiveness of information in EHR, the interviewed participants showed the value of having the medical history of patients’ electronically in helping with medical work. Having easy and comprehensive medical information help physicians in the diagnosis and evaluation process and in “medical decision making,” as described by a physician from Jenin. This led to increased accuracy of the evaluation of the patient medical status and more accurate medical service.

Having easy access to electronic comprehensive and detailed medical information that helps diagnose and achieve accurate medical service will eventually reduce medical errors, as interviews participants stressed. A

physician from Jenin said that the “medication errors got reduced through the electronic system. Moreover, other participants mentioned how the electronic system helps track errors, find mistakes, and correct them early. This also facilitates the follow-up process with patients.

One of the interesting features mentioned few participants was the warning feature during the data entry process. This feature will show a warning message in the system if the patient has a chronic or dangerous disease, such as “if a patient has HIV, COVID-19, Hepatitis or Allergy from drugs or anything then the system will warn the doctor when he opens the patient medical record” as described by a nurse from Nablus national hospital.

From a legal perspective, some participants showed how the EHR system provides legal protection for doctors, users, and hospitals in case of medical error or death. Because, according to a doctor from Tubas, “from a legal point of view, everything must be documented to protect you,”. When an accident happens, the investigation committees check the whole physician written orders and procedures. According to physiotherapy from Jenin hospital, “(Not written not done) it is legally, ethically and medically necessary especially for the accountability process.” According to Ear, Nose, and Throat specialist “through EHRs the documentation process is

more flexible and safety; the documentation is required and mandatory with HIS because of the legal liability to save the patients and HCPs rights”.

The admission and discharge process ensure the documentation process. “This process begins the moment the user enters the hospital and registers (Admission process) until the user gets out from the hospital (Discharge process) including all the provided medical and administrative services. It includes the patient drugs, radiology images, laboratory tests, medical results, visit notes, and the received meals inwards. It is worth mentioning that all patient movements are documented in this record” according to a networks engineer from Rafidia hospital.

The EHR system was perceived as facilitating the management level work at the organizational level, such as monitoring and assessing employees’ performance. Non-clinical staff also stress that the benefit of the EHR system is showing the status of medical devices; devices are working well or malfunctioning. In addition, to track daily inventory, the EHR system helps track resources and daily inventory at ward level i.e., “each ward has specific needles per day and if there is any ward in that day exceeds the limited quantity of needles, the EHRs displays that” according to pharmacy manager.

Moreover, respondents expressed the positive impact of the EHR system on their work patterns. The most frequent effect was that the EHR system sped up hospital staff's work compared to traditional written records. Therefore, many respondents said that the EHR system saves time and effort compared to the massive workload with paper-based records.

Moreover, the EHR system provides better service quality for patients, better decision-making, makes staff work easier, and saves hospital costs.

4.3.2 Smooth Flow of Information

A key perception by hospital staff that acts as motivation for using the EHR system is its ability to give a smooth flow of information. Participants shared information that shows how the EHR system enhances internal coordination and interaction in the hospital. Some of them used the phrase “flexible and smooth flow of information” between staff and departments in the hospital to describe the benefits of EHR in internal coordination. In addition, other participants mentioned that the communication process between medical staff became better with the EHR system.

This is also reflected in receiving orders between different departments and staff in a more organized and detailed way. A physiotherapist from Jenin described how the physiotherapy department receives an order from the

specialist (physiotherapy order) that contains the treatment and direction through the patient's electronic record”.

Moreover, a management level staff highlighted how accessing the documented information help him in solving problems and contentions between staff such as problems between the pharmacy and physicians.

This is also reflected in pharmaceutical work. Two pharmacists mentioned how the electronic system helps them to a better understanding of prescribing provided by doctors. Moreover, the EHR system also supports pharmacists in making accurate prescribing and mitigates errors. According to a public hospital pharmacy manager in Jenin, “I can be more accurate in prescribing the doses and drugs. I can check the latest physician notes and their prescribed drugs.” He also showed the difference between EHR and paper-based records and how this transition increases accuracy and reduces error. The most common problem with the handwritten prescription is the misunderstanding of the health provider's handwriting”.

In addition, it was highlighted by a deputy director of the central pharmacy from Tulkarm how EHR records give the inpatient pharmacist the ability to “discover the medication errors within physician notes and orders (doses/drugs names),” meaning that it will also help in correcting potential errors

4.3.3 Previous Handwritten Records Experience

Previous participants' experience with paper-based records is a motivator to adopt EHR systems due to the disadvantages of these types of records. Unlike the EHR system, the paper-based records were described by participants with several limitations that make them prefer electronic records over paper-based records. The most frequent expression as a negative point against paper-based records is “time and effort consuming.” The time and effort consuming were mostly linked to the moment when the medical staff wants to check a medical document for a specific patient: “[when] records were handwritten, it’s consumed my time and my effort especially when we wanted the patient's files. Sometimes, we wait for hours till we find the required records from the archive room”, according to a nurse from Nablus national hospital.

Another negative point related to paper-based records is that it requires large storage space which takes huge space from the hospital. In addition, having the records in paper form cause them at risk of damage or being lost, which was also considered a negative feature by many participants. Furthermore, the paper-based medical documents are not comprehensive and less accurate and could increase medication errors. In addition, paper-based records make it hard to follow up on the patient situation as flagged by some participants.

Other limitations and negative traits were mentioned regarding paper-based records which are: increase cost on hospital due to space and using a lot of paper, the potential duplication risk of forms, and the possibility of misreading handwriting, especially in pharmaceutical work, according to a pharmacist.

A clinical emergency doctor from Nablus National Hospital sums the comparison by saying: “The Electronic System is much better than handwritten records. The electronic records are useful, easier, flexible and faster than the traditional written records.”

4.4 Major barriers limit the proper EHR system adoption and implementation (Theme 3)

4.4.1 System Limitations and Drawbacks

The dissatisfaction over the EHR system limitations and drawbacks was concretely evident in interviewees' responses. Both clinical and non-clinical staff showed dissatisfaction over the system mentioning that the system is outdated and requires essential updates. A doctor from Tubas said that the system should be updated to consider HCPs' requirements on what should be included in the system.

One of the implications for the lack of updates is that the doctors cannot find all the diagnoses they want to fill in within International Classification

Diseases (ICD) because the system is not updated, according to the same doctor from Tubas. Few clinical staff expressed their dissatisfaction regarding the long ICD list saying that “it’s a very long list and it consumes the doctor's time especially when there’s a lot of patients in the waiting room”, according to a psychotherapist from Jenin hospital.

The need for updates is also related to the need to increase the response time of the electronic system function and fix some features, such as scanning the external reports, according to two non-clinical staff from Jenin. “For nursing department, the workload doesn’t fit with the current system speed (the workload in an emergency is huge and the system response time is slow) and this is the most important obstacle for patient and nurse.” according to the head of the emergency department at National Governmental Hospital.

The issue of the lack of updates was linked to the fact that updates can’t be done internally. The non-clinical staff interviewed in this study said that any updates or edits on the system should be done by a third party. The third party is the Turkish company (DataSel) that the system was purchased from. This creates a limitation to updating the system for two reasons.

1. For updating the system, the permission of the Turkish company is required, and the process of receiving a response from the company takes

a lot of time and causes a lot of delays, and sometimes with no results, according to some of those respondents.

2. The second reason, which is linked to the first point, is that the “Turkish company doesn’t react quickly and effectively with our reported problems because we [the Ministry of Health] don’t pay” according to a non-clinical staff from Jenin. This issue was linked by another non-clinical staff from Rafidia hospital in Nablus with the fund shortage from USAID. The foregoing impacted the ability to submit payment to the Turkish company to update the system. It is about the maintenance contract renewal.

IT staff flagged the fact that the hospitals' IT/ engineering units have a limited window to improve the system because the authority is with the Turkish company.

In addition to the drawbacks mentioned above, interview responses spotted limitations in the system that affect their ability to carry specific hospital tasks. One of the limitations of the system is that it doesn’t cover some of the non-medical types of tasks. Its results are clear on using other systems in the hospital, in addition to the Avicenna EHR system.

For example, some pharmaceutical tasks are being done through another system (Oracle), mainly for tasks related to pharmacy warehouse, reports, orders, and daily inventory. This causes pharmacy staff to enter the same

data twice, both on the EHR and other systems. A deputy director of the central pharmacy from a hospital in Tulkarm said in this regard: “I should enter all the Oracle orders again in Avicenna system, and this consumed my time and effort because the Oracle is not merged with Avicenna. Each one of these two systems has its advantages but I wish that the two systems are merged (where they complement each other).”

The same issue applies with finance staff, where they also use another system for cash (cash system), provided by the Ministry of Finance, according to a network engineer from Rafidia hospital in Nablus.

Pharmacists face problems with the current electronic system when it comes to numbers and statics input problems (especially the invoices). Pharmacy warehouses concentrate on “input, output, quantities, numbers, statistics, annual expenses of components and drugs, as well as the spent money, and daily inventory reports” according to a pharmacy manager.

Moreover, the system does not provide flexibility in editing records that are already in the system. Some respondents flagged their inability to edit the existing errors if there was a need for any change such as adding, editing, or deleting information, records, or sections. This is linked to data entry issues, making it hard to fix misspelling errors. Two radiologists said how the

system doesn't allow them to write notes on the images they enter into the system or delete the wrong or fake images.

4.4.2 Lack of Connectivity Between Different Stakeholders

The outstanding barrier that hinders the ability to fully switch over to the EHR system is the lack of connectivity between different stakeholders. The main barrier that was flagged by hospital staff was that the Avicenna system is only being used within public hospitals and is not shared with PHC and private hospitals. In addition, the EHR system is not linked to the Public Administration of Insurance. Aside from these stakeholders, it was flagged by a few respondents that the EHR system is not linked with the Ministry of Interior and the Ministry of Finance.

This limitation in adopting the EHR system between different stakeholders has several implications. For example, if a patient came from a hospital that is not linked with the Avicenna HIS, where is no standardized shared electronic medical records. In that case, it is going to "affect the diagnosis process, accuracy in providing treatment, duplication, medication error, misunderstanding, loss important information, besides wasting time for both the patients and physicians," according to a nurse from Nablus National hospital.

The lack of connectivity with the Ministry of Finance causes the hospitals to use a parallel system to carry some of the financial tasks, whereas the cash system provided by the Ministry of Finance, not connected with the Avicenna system provided by MOH. Therefore, the personnel work on two systems, besides the Oracle system for the pharmacy.

Moreover, any external laboratory tests cannot be scanned to the electronic system because most of the relevant stakeholders are not linked with public hospitals' electronic systems; therefore, the hospital staff needs to use handwritten reports rather than electronic ones.

This outstanding barrier hinders the ability to scale up the EHR system and causes a dependence on handwritten records which further affects work patterns and service quality.

4.4.3 Human Negative Practices

Another outstanding obstacle that impedes the adoption of the EHR system is the persistent human practices that stand in the way of adoption. The first type of these practices is those from medical staff. Multiple issues were mentioned under this category that is linked to medical staff practices that limit the ability to adopt EHR systems effectively. Several errors were spotted by some of the participants.

The first type mainly focused on physicians' practices that associated with several issues regarding medication errors. The mismatch shifts between the A, B, and C shifts. Despite what was mentioned above about how the EHR system reduces error, one respondent showed a mismatch between morning and night shifts regarding prescriptions. It happens when the specialist checks the patient's wards in the morning shift, then in the night shift, the other physician (non-resident doctor) came where he/she may copy the previous shift prescription/ admission record, or may read the last notes/prescription wrongly, or may describe a different dose. Some physicians describe drugs without returning to the latest visit/physician notes, where there is some kind of drugs that cannot be ordered without a specific laboratory test or filling particular biological forms from a specialist doctor. A pharmacist from Jenin said when this issue occurs, "my role as pharmacist comes to correct all these medication errors. These mistakes are not because of the electronic system but because of the doctor itself".

Additionally, the doctors don't provide enough details when prescribing drugs, this cause problem when prescribing drugs. Some physicians cannot distinguish the scientific names and commercial names of drugs. According to a pharmacist "there is should be fit between the patient condition and prescribed drugs in term of name and dose, i.e., there are a lot of drugs that

have similar components and names, till now there are physicians who do not differentiate among commercial and scientific names”.

Another error is associated with the lack of awareness of the International Classification Diseases (ICD) list which is provided by the World Health Organization (WHO). This list is the adopted classification list within the Avicenna software and it is used for prescribing drugs. According to a participant from Jenin hospitals “It returns to the doctor experience in reading, spelling and knowing the international classifications of diagnosing that is why there are still medication errors. Therefore, the doctors should know the scientific names of drugs not only the brand names”

Another error was associated with the doctors’ reluctance of using the electronic system, where few participants spotted how HCPs' mindset toward electronic documentation is an obstacle in adopting EHR systems. One of those described the lack of “seriousness” among doctors in considering electronic medical records, such as during follow-ups. While other participants flagged the “impatience” and “laziness” of some HCPs regarding using the electronic system due to time pressure, which causes spelling errors. On the other hand, one participant from Nablus said that “there is still some neglect by some physicians where they still write on papers, they don’t enter everything into the electronic system”.

Another error is associated with the lack of proper training on using the system. Despite those most participants mentioned that they got training on how to use the system, a managerial position staff mentioned that some of the HCPs are not trained well to deal perfectly with the EHR system. Moreover, the participant's responses when asked about who provided the training were varied. For example, some participants got trained by the Turkish company that established the system while others were trained by the hospital's IT department. In contrast, other respondents said they got trained by colleagues or the department manager. This variety and inconsistency in training providers show the lack of a unified official source that provides a unified training material on how to use the EHR system, creating an obstacle that acts at the human level.

The second type mainly focused on practices of non-clinical staff, mainly through data entry issues. Hospital employees face data entry issues in the system, due to misspelling entries which were linked to increasing error and inaccuracy. This issue is mainly seen in pharmaceutical and administrative work. In pharmaceutical, some clinical staff mentioned spelling errors usually happen when physicians enter the data, because “physician don’t have enough time to search for the correct exact name of drugs or components, especially there is a lot of drugs have the similar commercial name or components”, according to a physician from Jenin. Those

respondents considered this as the main reason for a medication error due to inaccuracy in pronunciation of drug names.

For administrative work, misspelled entries happen when a registration department writes the patient ID number wrongly (as the system registers patients only by ID number). This might lead to duplication and inaccurate medical records. This lead in some cases to duplication, where the same patient had two files in the electronic system.

4.4.4 Resources Issues

The limitations in existing resources within public hospitals hinder the ability to expand the adoption of EHR systems. Some respondents flagged the shortage in the quantity and quality of hardware available in the hospitals and the lack of financial resources to cover the cost of repairing computers and digital devices.

Another limitation in resources is the “shortage in the number of Uninterruptible Power Source (UPS), where the current UPSs cannot hold all the hospital department. In fact, the central UPS directly linked with surgeries room, Intensive Care Unit (ICU), incubation, and some critical departments.”, according to a computer engineer from Jenin and other respondents. This shortage exacerbates the impact of the electricity shutdown that stops the medical and administrative tasks.

“All hospital aids, software, and hardware provided by USAID. Some time ago the USAID aids stopped for political reasons; therefore, the electronic system (Avicenna) was affected because of the stoppage of the USAID supports” according to an administrator in Rafidia hospital.

In addition, the lack of resources affects the requirements needed to carry the work on the EHR system. Many respondents said the system is slow; this was linked by a network engineer from Nablus Rafidia hospital with old existing servers in their hospital. Other respondents also mentioned a resource-related issue: the slow internet speed that causes the system to be slow.

4.4.5 System Inefficiencies

Although many tasks carried by both clinical and non-clinical are operated through the EHR system, the system still has some inefficiencies that reduce the coverage of tasks that can be carried electronically, and therefore lead to dependency on paper-based records.

The main issue that created inefficiencies in the system and was mentioned by the majority of respondents is the sudden system failure, stops, and freezing. The most frequent expression for this issue is that the system usually stops from half an hour to one hour but not more than that. In a few

cases, the system could stop for a “whole day or for many hours, according to a Radiologist technician from Ramallah.

The response of system failure from the hospital varies between respondents and their roles. Some of them said that when the system failure happens, they continue their work through paper-based records and then re-enter the data once the system is back. This causes additional workload on them in terms of data entry and limits the clinical ability of physicians and limits the ability of staff to check up patient files.

However, radiologists said they have to stop their work completely when a system failure happens, where the “medical image transfer process is all done only through the electronic system,” as described by a medical imaging specialist from Nablus National hospital. In addition, a data entry employee from Tulkarm said that she stops working when the system malfunctioned as “the registration department cannot register users; besides I cannot confirm and accept patients. Therefore, all work in hospital will stop, except the emergency”. For example, the work of the radiology and data entry department completely stops when the system freeze.

In addition, some of the respondents said that when the central server stopped, Avicenna stops working in all PMOH hospitals.

Moreover, respondents showed some shortages in system efficiency in covering certain tasks, causing them to use paper-based records instead of the electronic system. Paperwork is still used in some services such as drug prescriptions (Narcotic drugs), registration processes, external reports, and books, as mentioned by a few participants, in addition to the manually preparing statistical reports to be submitted to the Ministry of Health. According to an emergency nurse from National Governmental Hospital, “When patient enter departments to receive treatment, the patient should have specific paper, such as prescriptions, registration paper, death reports, injuries reports, some types of insurance (private insurance/ military insurance/ insurance that not linked with the ministry of health). Besides, the medical transfers, the narcotic drugs, the external books, also the external reports and the private hospital's reports (there is a particular and formal paper forms and format for the written external matters). There are some types of paper-based reports that we do not enter into the electronic system”.

Study participants spotted additional limitations in the EHR system coverage in terms of hardware. Some participants noted that some devices are not linked to the electronic system such as the scanner, causing the staff not to enter the external reports. In addition, an emergency room nurse stated that the monitoring devices (emergency patient monitor) and their results are not linked with the Avicenna system. Moreover, some participants

complained about how the electrocardiogram (ECG) device and its results are not linked to the EHR system.

Codebook and quotes table of interviews data

The research established a codebook and quotes table of interviews data. The codebook of interviews was established through the Maxqda software, where it includes a list of focused and sub-codes, descriptions of used codes, in addition to, examples, as illustrated in Table 4.1. Codebook enables ongoing tracking of how codes are being used to understand data well.

Table 4.1: Codebook of Interviews

Theme 1		Processed implementation of the EHR system, with minor differences across hospitals	
		Description	Examples
Focused code	Processed and divided implementation of EHR	This code refers to how participants describe their work and roles within the EHRs in a way that shows processed and divided responsibilities between staff	<i>I use the electronic health system in booking and making the needed orders</i>
Sub-codes	Roles of HCPs	This code is used when HCPs describe their role in the hospital	<i>I use the electronic record to check up the children medical history to know the taken drugs, made tests, laboratory results, previous diagnostics, given medical orders, prescribed treatment , besides the clinical examinations and X-ray images</i>
	tasks of clinical and non-clinical staff	This code is used when hospital staff, both clinical and non-clinical explain their tasks with the EHR system	<i>I use EHR to monitor the taken and described drugs doses.</i>
	ward-level responsibilities	This code refers when participants mention their responsibilities at the ward level	<i>I use it to write the vital signs of patients, besides entering the nursing notes and visit notes and writing drugs for patients.</i>
Focused code	Differences in connectivity and accessibility levels between hospitals	This code refers to specific differences in connectivity and accessibility between the different hospitals in this study.	<i>there's no clear and formal policy about the granted authority for HCPs</i>
Sub-codes	Primary healthcare centers are not linked with EHR system in all hospitals	This code refers to the issue that primary healthcare centers are not linked with EHR systems in all hospitals, but only in two governorates.	<i>Lack of connectivity between the Palestinian private, public, and primary health centers for sure affects the internal success and adoption of EHR</i>
	Unclear policy on granting authority for HCPs	This code refers to what participants describe as an unclear policy that lets them know the level of authority that staff has to access specific	<i>There's no clear and formal policy about the granted authority for HCPs.</i>

		departments in the hospital via EHRs, which is not unified across governorates.	
Theme 2		Perceived facilitators support the adoption and implementation of the EHR system	
		Description	Example
Focused code	Cognitive acknowledgment toward EHR system	This code refers to the cognitive acknowledgment that participants have shared that reflect their understanding and awareness of the usefulness of EHRs	<i>Electronic records are very useful and it's better than traditional written records.</i>
Sub-codes	Easier access to comprehensive medical information	This code is used when participants say that the EHR system allows them to have better access to comprehensive medical information	<i>I can access the patient record anytime I want here from my office.</i>
	reduce medical error	This code is used when participants say that EHRs have a positive impact in reducing medical error for clinical staff	<i>The electronic system reduced the possibility of medical errors.</i>
	better understanding prescribing	This code is used when participants state that EHR system helps them to understand more the prescribed drugs by doctors	<i>The electronic system leads to a better understanding of prescribing</i>
	save time and effort	This code is used when participants positively point out that the EHRs saved their time and effort when they do their work	<i>my job becomes more ease and flexible with the electronic system, where it saved my time and efforts</i>
	better service quality	This code is used when participants indicate that using the EHR system enable the staff to deliver better service quality than the handwritten records	<i>It increases the accuracy and the quality of provided services</i>
		Description	Example
Focused code	Smooth flow of information	This code is used when participants expressed how EHRs facilitated the flow of information, orders circulation, and communication process across wards and departments	<i>This connectivity allows flexible and smooth flow of the needed information to ensure the right treatment without duplication</i>

Sub-codes	The smooth and flexible flow of information	This code is used to refer to the use of EHR system in terms of smooth flow of information between hospital departments and wards as perceived by the participants	<i>The electronic system has information flows between the hospital departments, pharmacies, and medical crews.</i>
	receive orders	This code refers to the usefulness of EHR system in terms of the flow of orders between different departments, where they can receive and send orders electronically	<i>The physiotherapy department receives an order from the specialist (physiotherapy order) that contains the treatment and direction through the patient's electronic record.</i>
	solve problems between the pharmacy and physicians	This code refers to the possibility to solve problems between hospital staff as the EHR system facilitate the flow of information	<i>I use it to solve the problems between the pharmacy and physicians</i>
	better communication process	This code refers to the result of the flow of information, which create a better communication process between hospital staff	<i>the communication among the medical crew is more effective</i>
		Description	Example
Focused code	Previous handwritten records experience	This code is used when participants share their past experience with handwritten records and compare it with current electronic records.	<i>The Electronic System is much better than handwritten records, where electronic records are very useful and it's easier and faster than the traditional written records.</i>
Sub-codes	Costly	This code is used when participants describe the handwritten records where it cost more money	<i>it consumes the healthcare provider time, cost, and effort</i>
	duplication risk	This code refers to the duplication risk of orders and prescriptions that paper-based records caused	<i>In the written records it was very hard to follow up the patient condition, besides the duplications of orders, prescriptions and treatment</i>
	misreading handwriting	This code is used when participants negatively describe the handwritten records in terms of misreading the handwritten files	<i>In the written records, the physicians' notes and diagnostic wasn't clear enough</i>

	require large storage spaces	This code is used when participants indicate the negative impact of handwritten reports where it requires large storage spaces to store files	<i>The archive rooms take huge space from the hospital</i>
	not detailed	This code is used when participants indicate that paper-based records do not include detailed documentation of medical information in comparison to EHRs	<i>Not everything is documented in paper-based records.</i>
	time and effort consuming	This code is used when participants indicate how the paper-based records are time and effort consuming for hospital staff in comparison to EHRs	<i>It's consumed the physiotherapist's time and effort especially when we wanted the patient's files, we wait for hours till we find the required records from the archive room</i>
	damage risk	This code is used when participants said that paper-based records have the risk of getting damaged and lost, causing the loss of patients' information and data	<i>The written records may be damaged over time, it's also not accurate and not comprehensive.</i>
	difficult follow-up	This code is used when participants said that the written records made it hard for them to follow up the patient condition and medical history	<i>In the written records it was very hard to follow up the patient condition, besides the duplications of orders, prescriptions, and treatment</i>
	increased error	This code is used when participants indicate that paper-based records increase medical errors probability.	<i>The medication errors were high besides the weak diagnostic.</i>
Theme 3		Major barriers limit the proper EHR system adoption and implementation	
		Description	Example
Focused code	System limitations and drawbacks	This code is used when participants refer to the technical issues of EHR system, besides the limitation and drawbacks of it	<i>Another important problem I face while using the electronic record is after I write, confirm and send the order through the electronic system, it suddenly disappears from the whole system, so I rewrite it again and send it, in this case, I send two orders for the same content</i>

Sub-codes	The need for updates	This code refers to the hospitals' staff demand for the need to update the EHR system due to the technical issues	<i>The currently used system needs updates to increase the response time of electronic system functions.</i>
	the Turkish company delays	This code refers to delays that occur when the EHR system has issues, where it takes a long time for the Turkish company that developed the system to respond and resolve the technical issues	<i>It takes a long time till the Turkish company response to our stuck problems</i>
	multiple systems in the hospital	This refers to the issue of using multiple software within the hospitals that work in parallel and are not linked together.	<i>There are multiple systems in the hospital; not all systems are linked together, such as the cash system (provided by the ministry of finance) not linked with Avicenna HIS (provided by the ministry of health). Where the personnel works on two systems, besides the Oracle system for the pharmacy.</i>
	Inability to add sections, modify and delete	This code refers to the barrier that staff face when they are unable to add sections to the system	<i>The most important barrier I always face in my daily operation is how to add a new section in EHR system, especially when we want to open a new department</i>
Description			Example
Focused code	Lack of connectivity between different stakeholders	This code is used to refer to the lack of connectivity of the EHR system in public hospitals with other systems used by other stakeholders, such as primary healthcare centers and private hospitals.	<i>Lack of connectivity between the Palestinian private, public, and primary health centers for sure affects the internal success and adoption of EHR</i>
Sub-codes	Primary healthcare is not linked with the public hospitals	This code is used when participants say that the EHR system in some public hospitals is not linked with primary health care centers.	<i>We face a lot of problems because the primary healthcare centers are not linked with public hospitals</i>
	EHRs not shared among the primary, public and private hospitals	This code is used when participants say that the EHR system is not shared among primary, public, and private hospitals	<i>Avicenna system is not shared among the primary, public and private hospitals.</i>

	The insurance is not shared among public hospitals	This code is used when participants say that the EHR system is not shared and used with insurance service providers	<i>Avicenna system is not linked with the general administration of insurance</i>
		Description	Example
Focused code	Human negative practices	This code refers to the barriers that are caused by human practices, not by the system	<i>These mistakes are not because of the electronic system, it is because of the doctors themselves.</i>
	spelling errors	This code refers to spelling errors committed when entering data into the electronic system, which lead to medication errors	<i>the main reason for medication error is the accurate pronunciation of drug name/component.</i>
	pronunciation impatient	This code refers to when hospital staff commit mistakes and spelling errors due to their impatient	<i>That's usually happened with physicians and specialists because of spelling errors, pronunciation, time pressure, or impatience.</i>
	doctors still use paper forms	This code is used when a participant said that some doctors still using paper forms instead of EHR system	<i>There is still some neglect by some physicians, where they still write on papers, they don't enter everything into the electronic system.</i>
Sub-codes	data entry problems	This code refers to data entry problems that create other issues, including duplication	<i>The electronic system enters, recognizes, and registers the patient Only according to the ID number, so if the registration worker enters the wrong ID number, then the user will have two files in the database of the electronic system.</i>
	duplication	This code refers to the issue of duplication caused by spelling errors when entering data into the system	<i>It happened that the same user has 2 files in the electronic system (2 files of the same full names with the wrong ID number) and in this case, I cannot know the right and actual medical record of the user.</i>
	writing the wrong ID	This code is used when errors happen in writing patient ID but missing some letters or numbers, causing the patient to have the wrong file in the EHR system	<i>The electronic system enters and registers the patient according to the ID number, but it happened a lot that the registration department write the wrong ID number or write</i>

			<i>zeros instead of the ID number, and that lead to duplication and inaccurate medical records</i>
Description			Example
Focused code	Resources issues	This code refers to barriers related to lack or unrenewed resources in the hospitals	<i>There is should be enough computers, PCs, printers, screens, and equipment because the number of users increased continually</i>
Sub-codes	Lack of hardware	This code refers to the lack of hardware resources, such as computers, printers, screens, and other hard devices.	<i>There is a shortage in the numbers of computers and hardware</i>
	old devices	This code refers to the issue of old existed devices in the hospital that are not supported by the electronic system	<i>The existing hardware's are old and slow</i>
	USAID funding shortage	This code refers to funding shortage from USAID, which created the resources issue	<i>All the provided hardware's and aids were affected by the financial crisis because of Donald Trump, where all the hospital aids, software, and hardware provided by USAID</i>
	shortage in several UPSs	This code refers to the issue of shortage on the number of UPSs, where it's not an effective alternative when the electricity face power cut	<i>Shortage in the number of UPS</i>
	slow system	This code is used when participant describe the system itself as slow, which cause frustration to hospital staff that use it	<i>the electronic system is very slow</i>
	slow internet speed	This code refers to the slow internet speed that affects the EHR system	<i>Internet speed is slow.</i>
	old servers	This code refers to the issue of old servers that cause the EHR system to be slow	<i>The existing servers are very old.</i>
Description			Example

Focused code	System inefficiencies	This code refers to a number of inefficiencies in the EHR system that cause increased workload	<i>The sudden stoppage of the system while working and that cause delay in receiving and reviewing the patient results and reports</i>
Sub-codes	Using paper-based records	This code is used when participants say that they go back to using paper-based records in some situations due to EHR system inefficiencies	<i>If it stopped for long time, then I continue my work through the paper-based records, and when the system comes back from freezing I should do re-enter all the handwritten work to the electronic system.</i>
	system sudden failures	This code refers to the issue of system sudden failures that cause the EHR system to stop working due to high workload or electricity cut	<i>Sometimes the electronic system freeze while working, especially when there high load on the system</i>
	re-entering data	This code is used when participants mentioned that they have to re-enter the same data when they used the paper-based records while the system was not working due to the sudden failures	<i>when the system comes back from freezing I should do re-enter all the handwritten work to the electronic system.</i>
	Some devices not linked to the EHR system	This code is used when participants refers to coverage issues with the system when they said that some devices are not linked to the EHR system, such as the scanner and ECG devices	<i>we cannot scan and enter the external report into the electronic system because it is not linked to the system</i>

Table 4.2: Quotes of Interviews

Theme	Focused code	Quote	Respondent profile
Processed implementation of EHR system, with minor differences across hospitals	Processed and divided implementation of EHRs	Ensuring matching between the physician prescription (visit) and follow-up orders (ordered drugs) to correct errors if found	Pharmacist in Jenin Governmental hospital from Jenin
Processed implementation of EHR system, with minor differences across hospitals	Processed and divided implementation of EHRs	I can know the number of needed drugs and doses, besides the number of used drugs, besides the number of available drugs, such as (cancer drugs and rheumatism drugs)	a deputy director of the central pharmacy in Thabet Thabet Governmental Hospital from Tulkarm
Processed implementation of EHR system, with minor differences across hospitals	Differences in connectivity and accessibility levels between hospitals.	there's no clear and formal policy about the granted authority for HCP	network engineers in Rafidia hospital from Nablus
Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	the radiology images that return to any date/year, [in addition to] quick and easy storage and retrieval of any medical images	a medical imaging specialist in Nablus national hospital from Nablus
Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	comprehensive records that include the medical history of patients, where it includes the visit notes, test results, physicians' notes, allergies, surgeries, taken drugs, genetic diseases, chronic diseases, nursing notes, reports, diagnosis, and blood group	Emergency doctor at Nablus National Hospital from Nablus
Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	help physicians in the diagnosis and evaluation process and in "medical decision making,"	physician in Jenin Governmental hospital from Jenin

Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	medication errors got reduced through the electronic system	physician in Jenin Governmental hospital from Jenin
Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	if a patient has HIV, COVID-19, Hepatitis, or Allergy from drugs or anything then the system will warn the doctor, when the doctor opens the patient medical record	nurse in Nablus national hospital from Nablus
Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	from a legal point of view, everything must be documented to protect you	Doctor in Tubas Turkish Government Hospital from Tubas
Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	“(Not written not done) it is legally, ethically, and medically necessary especially for the accountability process	physiotherapy in Jenin Governmental hospital from Jenin
Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	through EHRs the documentation process is more flexible and safe; the documentation is required and mandatory with HIS because of the legal liability to save the patients and HCPs rights	Ear, Nose, and Throat specialist in Tubas Turkish Government Hospital from Tubas
Perceived facilitators support the adoption and implementation of the EHR system	Cognitive Acknowledgment Toward EHR System	This process begins the moment the user enters the hospital and registers (Admission process) until the user gets out from the hospital (Discharge process), including all the provided medical and administrative services. It includes the patient drugs, radiology images, laboratory tests, medical results, visit notes, and the received meals inwards, where all patient movements are documented in this record	networks engineer in Rafidia hospital from Nablus

Perceived facilitators support the adoption and implementation of the EHR system	Smooth Flow of Information	the physiotherapy department receives an order from the specialist (physiotherapy order) that contains the treatment and direction through the patient's electronic record	physiotherapist Jenin Governmental Hospital from Jenin
Perceived facilitators support the adoption and implementation of the EHR system	Smooth Flow of Information	I can be more accurate in prescribing the doses and drugs; I can check the latest physician notes and their prescribed drugs	a public hospital pharmacy manager in Jenin Governmental Hospital from Jenin
Perceived facilitators support the adoption and implementation of the EHR system	Smooth Flow of Information	discover the medication errors within physician notes and orders (doses/drugs names)	deputy director of the central pharmacy in Thabet Thabet Governmental Hospital from Tulkarm
Perceived facilitators support the adoption and implementation of the EHR system	Perceived facilitators support the adoption and implementation of the EHR system	“[when] records were handwritten, it’s consumed my time and my effort especially when we wanted the patient's files, we wait for hours till we find the required records from the archive room	nurse in Nablus national hospital from Nablus
Perceived facilitators support the adoption and implementation of the EHR system	Perceived facilitators support the adoption and implementation of the EHR system	The Electronic System is much better than handwritten records, where the electronic records are useful, easier, flexible, and faster than the traditional written records	clinical emergency doctor in Nablus National Hospital from Nablus
Major barriers limit the proper EHR system adoption and implementation	System Limitations and Drawbacks	it’s a very long list and it consumes the doctor's time especially when there’s a lot of patients in the waiting room	psychotherapist in Jenin Governmental hospital from Jenin
Major barriers limit the proper EHR system adoption and implementation	System Limitations and Drawbacks	For the nursing department, the workload doesn’t fit with the current system speed (the workload in an emergency is huge and the system response time is slow) and this is the most important obstacle for patient and nurse	head of the emergency department in Nablus National Hospital from Nablus

Major barriers limit the proper EHR system adoption and implementation	System Limitations and Drawbacks	Turkish company doesn't react quickly and effectively to our reported problems because we [the Ministry of Health] don't pay	a computer engineer in Jenin Governmental hospital from Jenin
Major barriers limit the proper EHR system adoption and implementation	System Limitations and Drawbacks	I should enter all the Oracle orders again in the Avicenna system, and this consumed my time and effort because the Oracle is not merged with Avicenna, where each one of these two systems has its own advantages, but I wish that the two systems are merged (where they complement each other)."	deputy director of the central pharmacy in Thabet Thabet Governmental Hospital from Tulkarm
Major barriers limit the proper EHR system adoption and implementation	System Limitations and Drawbacks	it's not good enough for quantities, numbers, statistics, annual expenses of components and drugs, as well as the, spent money, and daily inventory reports	pharmacy manager in Jenin Governmental hospital from Jenin
Major barriers limit the proper EHR system adoption and implementation	Lack of Connectivity Between Different Stakeholders	It is going to affect the diagnosis process, accuracy in providing treatment, duplication, medication error, misunderstanding, loss of important information, besides wasting time for both the patients and physicians	nurse in Nablus National hospital from Nablus
Major barriers limit the proper EHR system adoption and implementation	Human Negative Practices	my role as a pharmacist comes to correct all these medication errors. These mistakes are not because of the electronic system but because of the doctor itself	pharmacist in Jenin Governmental hospital from Jenin
Major barriers limit the proper EHR system adoption and implementation	Human Negative Practices	It returns to the doctor's experience in reading, spelling, and knowing the international classifications of diagnosis that's why there are still medication errors. Therefore, the doctors should know the scientific names of drugs not only the brand names	A computer engineer in Jenin Governmental hospital from Jenin hospital
Major barriers limit the proper EHR system adoption and implementation	Human Negative Practices	still some neglect by some physicians, where they still write on papers, they don't enter everything into the electronic system	A deputy the administrative and financial director in Rafidia hospital from Nablus

Major barriers limit the proper EHR system adoption and implementation	Human Negative Practices	physician don't have enough time to search for the correct exact name of drugs or components, especially there's a lot of drugs that have the similar commercial name or components	Physician in Jenin Governmental hospital from Jenin
Major barriers limit the proper EHR system adoption and implementation	Resources Issues	shortage in the number of Uninterruptible Power Source (UPS), where the current UPSs cannot hold all the hospital departments, where the central UPS is directly linked with surgeries room, Intensive Care Unit (ICU), incubation, and some critical departments	a computer engineer in Jenin Governmental hospital from Jenin
Major barriers limit the proper EHR system adoption and implementation	Resources Issues	All hospital aids, software, and hardware provided by USAID. Time ago the USAID aids stopped; therefore, also the electronic system (Avicenna) was affected because of the stoppage of the USAID supports	administrator in Rafidia hospital from Nablus.
Major barriers limit the proper EHR system adoption and implementation	System Inefficiencies	the system could stop for a whole day or many hours	Radiologist technician in Palestine Medical Complex from Ramallah
Major barriers limit the proper EHR system adoption and implementation	System Inefficiencies	the medical image transfer process is all done only through the electronic system	medical imaging specialist from Nablus National hospital
Major barriers limit the proper EHR system adoption and implementation	System Inefficiencies	when the electronic system stopped; the doctor cannot see the patient file, the pharmacy cannot see described prescriptions, the registration department cannot register users, besides I cannot confirm and accept patients. Therefore, all work in the hospital will stop, except the emergency	data entry employee in Thabet Thabet Governmental Hospital from Tulkarm
Major barriers limit the proper EHR system adoption and implementation	System Inefficiencies	When patients enter departments to receive treatment, the patient should have specific paper, such as prescriptions, registration papers, death reports, injuries reports, some types of insurance (private insurance/ military insurance/ insurance that not linked with the ministry of health), besides the medical transfers, the narcotic drugs, the external books, also the external reports and the private hospital's	emergency nurse in Nablus National Hospital from Nablus

reports (there is a particular and formal paper forms and format for the written external matters). There are some types of paper-based reports we don't enter into the electronic system

4.5 Discussion of Research Findings

“No study is so novel and with such a restricted focus that it has no relation to other previously published papers”. Thus, the research findings should be discussed in light of previous studies. The researcher should relate the study findings with other studies. If the research findings are similar to other studies, then it will support and strengthen the importance of the results which enhances the reader's trust. On the other hand, it is very important to indicate if the study findings differ from similar previous studies, where it is a sign that the study introduces new value/information, which enhances the importance of research results. (Hess, 2004, p.3).

Based on the foregoing, this section will display the research findings in the light of previous studies with a brief discussion of each finding in comparison with previous studies.

4.5.1 Processed and divided implementation of EHRs

Most clinical and non-clinical staff expressed tasks and roles regarding the EHRs implementation. For example, the clinical group used the EHRs to access patients' medical history and make medical orders and notes. At the same time, the non-clinical group used the EHRs to monitor, evaluate, and track work progress and personnel performance. Therefore,

each one of the groups has its tasks and responsibilities to perform through EHRs to enhance public healthcare. Accordingly, there are shared and organized tasks, roles, and responsibilities between hospitals wards regarding the EHRs implementation. This finding facilitates the EHRs implementation.

4.5.2 Differences in connectivity and accessibility levels between hospitals

Most respondents expressed a lack of uniform implementation of EHRs across MOH hospitals because there is no standard policy regarding the granted authority in terms of access to electronic system sections for HCPs. According to interviewees, there is a shortage of linkage between primary healthcare centers and MOH hospitals in Palestine. Only in Nablus and Ramallah city, the PHC connected with the public hospitals through HIS. Accordingly, the absence of uniformity affects the medical work for health providers and patients in terms of time, efforts, and provided medical services. Similar to Shawahna's (2019) study, it mentions that in Palestine the variation in delivering health services affect the patient, where patient do not have shared medical records; therefore, it affects the process of sharing patient medical information between health institutions. This finding restricts the EHRs adoption.

4.6 Enabling Factors

4.6.1 Cognitive Acknowledgment Toward EHR System

Almost every participant responded positively regarding the EHRs benefits in comparison with paper-based records. Clinical groups expressed how the warning feature regarding chronic and dangerous diseases within the Avicenna HIS system increased the quality of provided medical service and reduced the possibility of medical errors.

On the other hand, most interviewees expressed the documentation process, which offers legal protection for patients and health providers to ensure the accountability process (legal liability). In this part, the concerns about legal liability have been barriers in another study (Gesulga et al., 2017).

In addition, clinical and non-clinical groups expressed the admission and discharge process. In admission and discharge records, all patient movements should be documented. Different from Shawahna's (2019) study, which found that EHRs in PMOH hospitals should record and keep patient admission and discharge information.

Accordingly, HCPs aware of the EHRs value and benefits. This result contrast with the result of the previous study (Gesulga et al., 2017) where people resources, including awareness of HCPs, are one of the main

barriers that affect HIT implementation. Also, different from Hayajneh and Zaghloul's (2012) study, which found that lack of awareness toward HIT value is one of the most critical barriers that restrict the successful adoption of such a system in Arab countries hospitals. In addition, this finding contrast with Bates et al., (2003) study, which mentions that awareness, is a significant problem that cannot be overcome easily.

4.6.2 Smooth Flow of Information

Most interviewees expressed how Avicenna HIS software enhanced and facilitated the internal communication and coordination between health providers and hospital departments. In addition, it facilitated the movement of reports and orders between HCPs and related hospital wards. This seamless flow enables health providers from all wards to follow up on the medical and administrative issues. Similar to Shawahna's (2019) study, which shows that the EHRs enhance the communication process between HCPs. Also, Similar to Yusof et al. (2007) study, which found that internal interaction, is one of the success factors that ensure the successful execution of HIT.

4.6.3 Previous Handwritten record experience (Motivator Factor)

The results of the interviews indicate the pre-experience of paper-based records is one of the most critical reasons the HCPs have adopted the

electronic system and accepted it. The disadvantages of paper-based records and associated obstacles motivated all clinical and non-clinical groups to adopt and implement HIS. Similar to Salameh et al. (2019), it indicates the positive attitude toward computerization results from paper-based documentation problems and difficulties. Unsurprisingly, it can be considered a factor of a successful adoption.

Most of the respondents who experienced the traditional written records expressed how electronic-based records are much easier, flexible, and inclusive than paper-based records. Thus, despite the current problems of Avicenna, the HCPs still strongly recommend electronic records. This finding is similar to a previous study that found when the HCPs practiced HER. They recognized the positive effects of such systems where they realized that electronic-based records are easier than paper-based records (Ajami & Bagheri-Tadi, 2012).

Participants expressed many limitations where the misreading of handwritten orders and the time it takes to find the needed documents from archival rooms are the most critical limitation, resulting in medication errors, inaccuracy, and duplication, in addition to consumption of time, cost, and effort. Similar to Menachemi and Collum's (2011) study, which indicates that the transition process from

paper-based records to electronic-based records reduced the cost of used papers and saved storage spaces. In addition, it reduced the cost of care, where all received treatments documented in the electronic patient record where that prevent duplication.

4.7 Restricting Factors

4.7.1 System Limitations and Drawbacks

The findings from the interviews indicate dissatisfaction with Avicenna software regarding updates issues. The PMOH cannot meet the health providers' needs in terms of updates requirements because of the maintenance contract, which is expired (funding issues). Similar to Gesulga et al. (2017), it indicates lack of system maintenance and maintenance cost considered barriers that restrict the EHRs implementation. Also, Similar findings from a previous study's results showed that funding-related financial barriers are significant barriers that limit HIS implementation in hospitals (Khalifa, 2013).

On the other hand, interviewees from non-clinical groups expressed the Avicenna software limitations regarding the existence of multiple systems that are not linked through Avicenna HIS. The lack of integration of medical and administrative systems within hospitals consumed the

hospital staff time and effort, particularly the pharmacists and accounting department, to enter the same data into multiple systems. Similar to Gesulga et al. (2017), it states that the lack of integration of the EHRs with other existing information systems and the lack of EHRs applications standardization are considered barriers to HIT implementation.

4.7.2 Lack of Connectivity Between Different Stakeholders

According to interviewees, the lack of integration among stakeholders is one of the most significant barriers restricting the EHRs adoption and implementation. Lack of integration and standardization affects the quality of provided medical services in terms of variation in provided services, no standardized records, multiple systems within hospitals, dependency on paper-based records, and increased workload for health providers. It also consumed the patient time and effort. This finding is similar to previous studies that found standardization, interoperability, and interconnectivity obstacles limit the EHRs adoption and implementation (Ajami & ArabChadegani, 2013; Simpson, 2014; Kruse, et al., 2015). In addition, similar to Holden's (2011) study, which found inter-institutional integration associated with organizational barriers limit EHRs use.

4.7.3 Human Negative Practices

Some participants expressed negative practices of HCPs regarding prescriptions and orders, where medication errors were caused by physicians' wrong practices. Similar to Nightingale (2000) which indicates there are errors caused by prescribers such as wrong data entry, wrong in reading, or writing prescriptions. On the other hand, few participants expressed personality traits of HCPs affect such system adoption, such as laziness, lack of seriousness, and impatience. Similar to findings from previous studies (Hamid & Cline ,2013; Altuwaijri et al., 2011), which indicates physician attitudes and behavior toward such system influence and delay the EHRs adoption.

Few interviewees expressed the mistyping of administrative staff, especially the registration department, regarding entering the ID number wrongly during the registration process. Many medical and non-clinical staff expressed variation in the training of Avicenna, where not all health providers received formal standardized training. Similar to Holden (2011) study, which found informal training by colleagues and typing proficiency are barriers limiting EHRs implementation.

4.7.4 Resources Issues

Most medical and administrative staff expressed the shortage of resources, mainly the financial and technical resources. The lack of financial resources resulted from the stoppage of USAID funding. Lack of technical resources is obvious through the shortage of quality and quantity of hardware, outdated software, and slow connection speed. In addition, the inability to repair and maintain the current devices and software is related to financial obstacles. On the other hand, many respondents expressed that the electricity shutdown affects Avicenna because all hardware stop working due to the shortage in UPSs. Similar to Farzianpour et al. (2015) study which shows the shortage of financial and technical resources, including maintenance costs, lack of budget, and lack of hardware, are significant barriers that affect the implementation of Electronic Health Records. In addition, the same as the Holden (2011) study, which indicates the electricity (power failure) and the system's speed as barriers to EHRs implementation.

4.7.5 System Inefficiencies

Many HCPs expressed increased workload regarding the sudden stoppage of Avicenna software. In this case, most hospitals departments should document everything on paper-based records, then re-enter all the

handwritten work to the electronic system. Some wards stop their work totally because their medical and administrative works depend entirely on the electronic system, such as the radiology and data entry department. Many respondents mentioned that there are still paper-based records in their daily works, such as external documents, death reports, and narcotic drugs. In addition, many clinical and non-clinical expressed how the unlinked devices to EHRs such as scanners, ECG, and monitoring devices, force the administrative and clinical staff to enter data into EHRs by themselves, resulting in increased workload. Similar to Ayatollahi et al. (2014) which indicates that the time HCPs spent on data entry increased their workloads. Also, like Boonstra and Broekhuis (2010) study which indicate the time required for entering the data and the time needed to transfer data from paper-based records to the electronic system considered time barriers that affect EHRs implementation.

4.8 Theoretical Framework

The study uses semi-structured in person interviews to collect qualitative data from different HCPs from PMOH hospitals to identify key factors that influence the EHRs adoption across public hospitals. The researcher has recorded all in-person interviews, and then fully transcribed all recorded interviews. All transcribed interviews were analyzed through

Maxqda software where key and sub-themes emerged along with a codebook of interviews.

The data analysis procedure goes through three cycles to reach refined codes and themes that present the study findings. During the in-depth reading of interviews transcripts, several codes and categories were noticed through participants' experiences, concepts, and challenges. The first coding cycle involved grouping segments that have relation to generating initial codes. This cycle generated more than 150 codes.

Second coding cycle (grouped codes) under categories for codes that respond to similar concepts. This cycle manages to group the initial codes under less than 60 codes. Then the data went through the third cycle of coding to create focused coding by further grouping for second cycle code to generate sub-themes under the main themes of the study. Through this cycle, 10 sub-themes have emerged.

The final coding cycle aimed to generate key study themes that these sub-themes will be under, and those themes will shape the grounded theory of the qualitative analysis undergone for this study. Three key themes have emerged from the final data analysis cycles. By describing the relationships between these three themes, a theoretical model has emerged that responds to the study's overarching objectives.

According to Scott (2009) and Charmaz (2015), open coding is a basic step for generating theory. During the open coding, the key categories will merge via recognizing the relationships among categories and via grouping the similarities under relevant categories.

All emerged themes are interconnected and have logical relations, and together they form and present a theory that frames the enabling and restricting factors of EHRs adoption and implementation across PMOH hospitals. Theory evolves during actual research, and it does this through continuous interplay between analysis and data collection” (Strauss & Corbin, 1994. p. 273). On the other hand, Glaser and Strauss (1968, p.3) point out that the “theory discovered during data collection will fit the situation being researched and will work when put into use”.

The three emerging themes shape a theoretical model that maps out the enabling and restricting factors to EHRs adoption and implementation in Palestinian public hospitals. The model below shows how the three themes interact to give a theoretical model grounded by data that explains the factors influencing the adoption of the EHR system. The three themes are mainly divided into two categories the former is enabling factors while the latter is restricting factors.

The first theme, “processed implementation of the EHR system.” In this part, “the processed and divided implementation of EHRs” shows how HCPs and non-clinical groups achieved their tasks, roles, and responsibilities regarding EHRs smoothly and uniformly. Therefore, it acts as enabling factor. In contrast, the other part of the theme, “the differences in connectivity and accessibility levels between hospitals.” shows no linkage with PHC and no standardized accessibility between PMOH hospitals; therefore, it limits the EHRs implementation; consequently. It acts as a restricting factor. Thus, the first part of the theme acts as a facilitator, while the second part acts as a barrier.

The second theme, “Perceived facilitators support the adoption and implementation of the EHR system.” reveals the perceived benefits and facilitators of the EHRs by clinical and non-clinical groups result in support and facilitate the adoption of the EHR system in public hospitals in Palestine. Therefore, it is considered as enabling factor.

The third theme, “Major barriers limit the proper EHR system adoption and implementation.” reveals the perceived barriers of the EHRs by HCPs and non-clinical groups by referring to the drawbacks, limitations, negative practices, and obstacles that limit the adoption of EHR systems in public hospitals in Palestine. Therefore, it acts as a restricting factor.

While the enabling factors need to be scaled up to maximize the adoption process, different stakeholders and healthcare executives need to address the restricting factors to develop a proper response to ensure the uniform and effective adoption and implementation process of the EHRs.

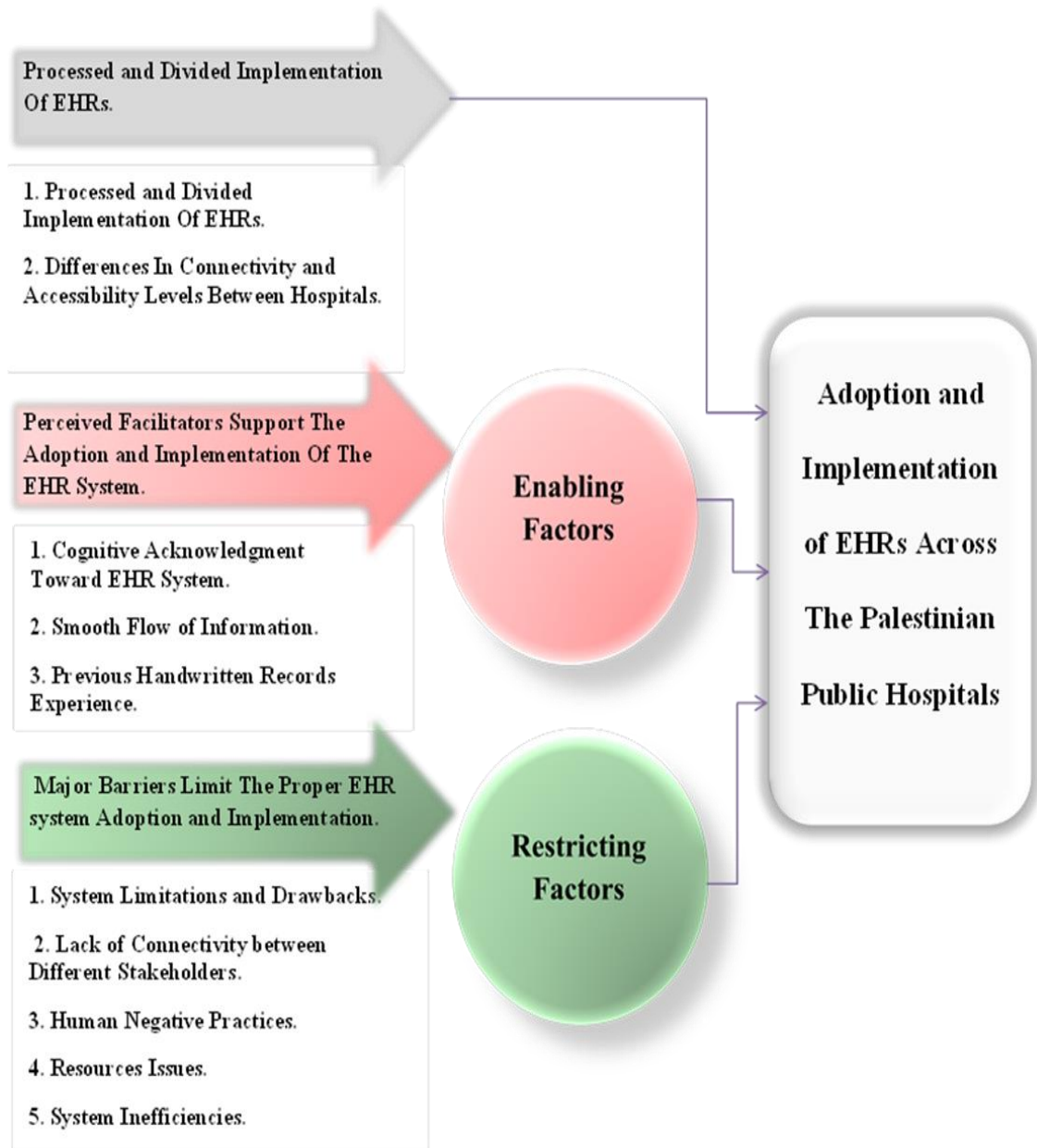


Figure 4.2: Theoretical Model

4.9 Summary of Major Factors and Research Answers

A. All occurred barriers from restricting factors are categorized into five categories

Table4.3: Summary of Major Barriers

Financial Barriers	Technical Barriers	Organizational Barriers	Human Barriers	Time Barriers
Lack of available funding.	Shortage in hardware: Desktop computers, laptops, printers, screens, UPS, equipment, and devices.	(A)The key relevant stakeholders are not linked with PMOH hospitals: <ol style="list-style-type: none"> 1. PHC is not linked with PMOH hospitals, except Nablus and Ramallah public hospitals. 2. Private hospitals are not linked with public hospitals. 3. General administration of insurance not linked with PMOH hospitals. 4. Ministry of Finance is not linked to PMOH hospitals except a few hospitals. 5. Ministry of Interior is not linked with PMOH hospitals. 	(A) Personality Traits of HCPs: laziness, lack of seriousness, and impatience. (B) Mistyping errors by administrative staff. (C) HCPs awareness of the scientific and commercial names/components of drugs. (D) HCPs misspelling and pronunciation issues via ICD list and prescription.	(A) Times it takes to transfer information from paper-based records to the electronic system. (B) Time barriers associated with data entry issues, including: Re-enter all data from paper-based records to electronic systems, in case of: <ol style="list-style-type: none"> 1. External documents/reports. 2. Death reports. 3. System malfunctions because of the central server's stoppage or Electricity failure.

		<p>(B) No formal policy about granted authority/ accessibility for EHRs sections.</p> <p>(C) Existence of multiple systems which not merge:</p> <p>Oracle system, Avicenna HIS, and cash system.</p> <p>(D) Variation in the training:</p> <p>Hospital staff received their training from IT, the Turkish team, and colleagues.</p> <p>(E) Cannot fix the stuck issue or improve anything without the Turkish company/Dataset permission.</p>	<p>(E) Mismatch of orders/notes between shifts.</p>
Stoppage of USAID funding since 2014/2015	<p>Slow hardware:</p> <p>Slow computers and laptops.</p>		
Expired Maintenance	<p>Old hardware:</p> <p>Old computers/laptops,</p>		

e contract
for years.

old servers, and old
printers.

Slow software:

Slow response time.

Slow internet
connection.

**Outdated
software:**

Lack of updates
result in:

(A) Scanner, ECG,
and monitoring
devices are not
linked with the
Avicenna system.

(B) ICD list doesn't
contain all
diagnoses.

Missing features:

(A) Inability to add,
edit or delete

(B) Avicenna only
deals with the ID
number.

**Avicenna cannot
handle the
pharmaceutical
work:**

Numbers, statics,
invoices, and
quantities.

System malfunction
/sudden stoppage

B. All occurred facilitators from enabling factors are categorized into four categories.

Table4.4: Summary of Major Facilitators.

Human Facilitators (HCPs)	Software Facilitators (Avicenna Features)	Organizational Facilitators	Past experience with paper-based records
Awareness and knowledge of HCPs toward computerization values and benefits in comparison with pre-experience of paper-based records.	Alert feature of chronic and dangerous diseases. e.g., COVID-19, HIV, and Hepatitis.	The documentation process is mandatory. “Not written, not done.”	Limitation of traditional written records motivates health providers to adopt EHRs. Major limitations that motivate HCPs to adopt EHRs include: 1. The time it takes to find the needed report/test. 2. Archival rooms take huge spaces. 3. A lot of papers and pens 4. Misreading of handwritten orders, which lead to misunderstanding and medication errors regarding the drug prescriptions and orders. 5. Duplication of tests and orders.

6. Paper Files are damaged and lost over time.

7. Lack of documentation process.

8. Increase cost, time, and effort on hospitals regarding archival rooms requirements.

9. difficult to follow-up patient condition.

10. Not comprehensive.

Admission and discharge process:

Contain the admission and discharge records.

Internal communication and coordination between HCPs.

Contain the Radiology Images':
e.g., MRI, X-ray, and CT/CAT

Processed and divided implementation of EHRs across wards and departments.

Contain all the results of laboratory tests.

Contain All Types of Notes:

e.g., visit notes and physician notes, and nursing notes.

All types of orders:

e.g., follow-up orders and physician orders, and administrative orders

Provide the Accessibility to:

Medical history

Contain All Types of Reports:

e.g., Medical reports and administrative reports.

Ability to Book Appointments:

e.g., Surgeries, visits, reviews, and checkups.

Ability to Track, Monitor, Assess and Supervise:

Resources, work progress, personnel performance, medical orders, prescriptions, notes, orders, and reports.

In addition to the ability to discover medication errors.

Ability to Register patients

Ability to store and retrieve medical
and administrative information.

Chapter Five

Conclusion and Recommendations

This chapter presents the research conclusion and practical implications in addition to the study limitations.

5.1 Conclusion

The findings fully answer all research questions which include:

1. How do healthcare professionals (Doctors, Pharmacists, and Nurses) and non-clinical groups ensure the uniform adoption of EHRs across public hospitals?
2. What are the enabling factors (facilitators) that support the EHRs adoption and implementation in public hospitals?
3. What are the restricting factors (barriers) that restrict EHRs adoption and implementation in public hospitals?

The findings fully answer all research questions by clarifying the ward-level implementation of HCPs and non-clinical groups, besides highlighting the main issues limiting the uniform implementation of EHRs in PMOH hospitals.

This qualitative research identified five major barriers and three major facilitators to EHRs implementation and adoption across Palestinian hospitals. It also provided a theoretical framework of enabling and restricting factors. Five major barriers include System Limitations and Drawbacks, Lack of Connectivity Between Different Stakeholders, Human Negative Practices, Resources Issues, and System Inefficiencies. The three major facilitators include Cognitive Acknowledgment Toward the EHR System, Smooth Flow of Information, and Previous Handwritten Records Experience.

All occurred barriers and facilitators that emerged in enabling and restricting factors are categorized into five major barriers and four major facilitators to form a holistic understanding of the current status of EHRs. Financial, technical, human, time in addition to organizational barriers are the five major categories of barriers and challenges that restrict the successful implementation of EHRs. On the other hand, the previous experience with paper-based records, Avicenna HIS features, human and organizational facilitators are the four major categories of facilitators that support the successful implementation of EHRs.

Healthcare executives and stakeholders are recommended to sustain said facilitators and strengthen them more for the sustainability of electronic

health system execution. For said obstacles, stockholders can overcome them or minimize their negative impacts by following the research implications to handle said obstacles effectively.

HCPs can consider said barriers, especially the human barriers to avoid them. Also, they can consider facilitators as motivators. On the other hand, the government can consider the research implications to enhance the reality of EHRs in governmental hospitals. For example, the government finds another alternative financial source rather than USAID to handle the financial barriers effectively. In addition, the PMOH can consider the aforementioned obstacles particularly the organizational barriers. Also, they can take into account the research implications. For example, The PMOH links the key relevant stakeholder to enhance the interconnectivity in the Palestinian health system.

To the researcher knowledge, this is the first research to qualitatively explore the enabling factors (facilitators) and restricting factors (barriers) across PMOH hospitals.

5.2 Implications

The study provides practical implications for healthcare executives in PMOH, and stakeholders.

➤ Practical implications for healthcare executives and stakeholders include:

- Link the key and relevant stakeholders through the Palestinian MOH HIS through the following recommendations:

1. Link the primary healthcare and governmental hospitals through the HIS in all hospitals in West Bank to ensure uniform medical services and flexible flow of patient medical information.
 2. Link the financial system (cash system) and pharmaceutical system (Oracle) through the HIS (Avicenna) to provide seamless, interconnected, and standard administrative processes.
 3. Merge the Ministry of Interior with the Avicenna system to provide the basic information of patients automatically.
 4. Link the General Administration of Insurance with public hospitals HIS to ensure the seamless and standard flow of medical records and information.
 5. Link the Ministry of Financial with all government hospitals HIS to facilitate and accelerate the financial work.
- PMOH finds alternative financial sources rather than USAID to handle financial obstacles effectively.
 - Give uniform training courses for all hospital staff continuously by IT specialists regarding the EHRs functions and importance as a

reminder for old health workers to motivate them more and enhance their awareness and knowledge. Also, for new health workers to avoid mistakes and make them qualified to deal with such systems.

- Establish a formal policy regarding the authority of access to EHRs sections for standardization accessibility.
- The Pharmacy department gives ongoing training or lectures about ICD list issues and drugs matters regarding the commercial and scientific names and components to enhance HCPs awareness and knowledge toward such critical issues.
- Provide ongoing awareness lectures about the importance and influence of HCPs' practice, attitude, and behavior on patient safety and the medical process.
- Give training courses for the registration department regarding typing proficiency to avoid files duplications and inaccuracy.
- Knowledge contribution for researchers in the HIT area include the following:
 - Future studies should focus on the main reasons beyond the shortage of linkage between PHCs and Palestinian public hospitals and how this shortage affects the delivery of health services.

5.3 Limitations

The most important limitation of the study is represented through the interviews time period. The researcher interviewed five public hospitals during the coronavirus pandemic and physicians' strike. The researcher found that there was a shortage of healthcare providers across the public hospital wards and departments. Therefore, future studies should focus on more HCPs to examine the study factors to know if they can be applied equally to other healthcare settings. Conducting the same study in different settings may generate different findings. In addition, future studies should target all public hospitals in West Bank to generalize findings across all PMOH hospitals.

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Appendices

Appendix 1

Factors that affecting EHRs adoption and implementation:

Decoding the end user perspectives in order to map the dynamics and complexity of novel changes

العوامل التي تؤثر على عملية تبني وتطبيق السجلات الصحية الإلكترونية: فك ترميز وجهات نظر المستخدم النهائي من أجل رسم خريطة لديناميكيات وتعقيد التغييرات الجديدة

Research Aims: The benefits of electronic health records (EHRs) have been widely publicized. Irrespective of the setting and healthcare environment, EHRs offer a range of benefits to clinical and non-clinical staff in a healthcare setting. However, the technological and non-technological aspects of EHRs bring their challenges to a healthcare institution. The research is based at governmental hospitals which have overseen a partial implementation of EHRs. The researcher aims to understand the dynamics of this implementation and explore key factors that influence EHRs adoption across the hospital's wards. The researcher is likely to work with three distinct groups of actors in the hospitals in order to establish the current status of the EHRs in the hospitals.

أهداف البحث: تم الإعلان عن فوائد السجلات الصحية الإلكترونية على نطاق واسع بصرف النظر عن المكان وبيئة الرعاية الصحية، تقدم السجلات الصحية الإلكترونية مجموعة من الفوائد للموظفين السريريين وغير السريريين في بيئة الرعاية الصحية. ومع ذلك، فإن الجوانب

التكنولوجية وغير التكنولوجية لسجلات الصحة الإلكترونية تجلب تحدياتها الخاصة إلى مؤسسة الرعاية الصحية. يستند البحث على المستشفيات الحكومية التابعة لوزارة الصحة الفلسطينية. الباحث يهدف إلى فهم ديناميكيات تنفيذ السجلات الصحية الإلكترونية واستكشاف العوامل التي تحول دون اعتماده عبر المستشفيات. من المحتمل أن يعمل الباحث مع ثلاث مجموعات متميزة من الجهات الفاعلة في المستشفيات من أجل تحديد الوضع الحالي للسجلات الصحية الإلكترونية في اجنحة المستشفيات الحكومية.

Research Implications: The research has huge implications for both the organization and stakeholders within and outside the organization. The research will aim to capture key insights from three different clinical and non-clinical groups of actors. These actors are at the heart of operation for the organization, and their perspective will help uncover some of the practices associated with the novelty of EHRs. At this stage of research, the researcher's sole objective is to map out the different views in relation to the functionality of EHRs. This would then give us a strong foundation to build a case for best practices within the hospital. In addition, we are likely to uncover a comprehensive narrative that can form the basis for future policymaking. Given the nature of the research, the researcher is undertaking a qualitative approach to understanding key factors that affect EHRs adoption within the hospitals. The researcher will be conducting 20-30 semi-structured interviews with each group of actors. The groups are as follows:

آثار البحث: البحث له آثار ضخمة على كل من المنظمة وأصحاب المصلحة داخل وخارج المنظمة. سيهدف البحث إلى الحصول على رؤى رئيسية من ثلاث مجموعات مختلفة من الممثلين الإكلينكيين وغير الطبيين. تقع هذه الجهات الفاعلة في صميم عملية المنظمة وستساعد وجهة نظرهم في الكشف عن بعض الممارسات المرتبطة بحدثة السجلات الصحية الإلكترونية. في هذه المرحلة من البحث، الهدف الوحيد للباحث هو تحديد وجهات النظر المختلفة فيما يتعلق بوظائف السجلات الصحية الإلكترونية. هذا من شأنه أن يمنحنا أساساً قوياً لبناء حالة لأفضل الممارسات داخل المستشفيات. من المرجح أن يتم كشف النقاب عن سرد شامل يمكن أن يشكل الأساس لصنع السياسات في المستقبل. نظراً لطبيعة البحث ، فالباحث اتبع نهجاً نوعياً لفهم حواجز التبني داخل المستشفى. سيتم إجراء 20-30 مقابلة شبه منظمة مع كل مجموعة من الممثلين. المجموعات هي على النحو التالي: الأطباء والممرضات والإدارة العليا (الأدوار غير السريرية)

- a) Ward-based Doctors/Physicians
- b) Ward-based Nurses
- c) Senior Management (non-clinical roles)

Appendix 2

Consent Form

1	I have read and understood the information about the project, as provided in the information sheet لقد قرأت وفهمت المعلومات المتعلقة بالمشروع، على النحو المنصوص عليه في ورقة المعلومات	<input type="checkbox"/>
2	I have been given the opportunity to ask questions about the project and my participation قد أتيحت لي الفرصة لطرح أسئلة حول المشروع ومشاركتي	<input type="checkbox"/>
3	I voluntarily agree to participate in the project أوافق طواعية على المشاركة في المشروع	<input type="checkbox"/>
4	I understand that I can withdraw at any time without giving reasons and that I will not be penalized for withdrawing, nor will I be questioned on why I have withdrawn أفهم أنه يمكنني الانسحاب في أي وقت دون إبداء الأسباب وأني لن أعاقب على الانسحاب، ولن يتم استجوابي عن سبب انسحابي	<input type="checkbox"/>
5	The procedures regarding confidentiality (e.g., the use of names, pseudonyms, anonymization of data, etc.) have been clearly explained to me تم شرح الإجراءات المتعلقة بالسرية (مثل استخدام الأسماء والأسماء المستعارة وإخفاء هوية البيانات وما إلى ذلك) بوضوح لي	<input type="checkbox"/>
6	The use of data in research, publications, sharing and archiving has been explained to me تم شرح استخدام البيانات في البحث والمنشورات والمشاركة والأرشفة لي	<input type="checkbox"/>
I consent to participate in this project أوافق على المشاركة في هذا المشروع		YES NO
I consent to any information I provide to the project being used in the writing up of the research, in publications, uploaded to websites and included in archives of research reports, provided that unless I give my express permission, my name and other identifying personal details will <u>not be associated with the information</u> I provide أوافق على استخدام أي معلومات أقدمها للمشروع في كتابة البحث، في المنشورات، وتحميلها على مواقع الويب وإدراجها في أرشيفات التقارير البحثية، بشرط ما لم أعطي إذنًا صريحًا، فلن يتم ربط اسمي وتفاصيل التعريف الشخصية الأخرى بالمعلومات التي أقدمها		YES NO

Signed (توقيع):

Date (التاريخ):

Appendix 3

Semi-structured Interview Questions

The Clinical Group Questions:

1. Can you please introduce yourself and your role in the hospital?
2. Can you please tell me what is that you know about the patient's health record?
3. Are you involved in any aspect of the patient health records?
4. What system is used in the hospital?
5. Can you share some experience of working with manual or electronic records? (How were your duties carried out before EHR was brought into operation)
6. If the EHR is stopped in operation today, what impact will it have on stakeholders (doctors, nurses, pharmacists)?
7. How are the patients benefitting from this?
8. How has EHR changed your work patterns? (Working shifts, resources, efficiency)?
9. What are the main drawbacks of the current system?
10. What are the main obstacles to EHR adoption and implementation?
11. How was EHR introduced to you? (Did you undergo any specific training before using this version of EHR?)

The Non-clinical Groups Questions:

1. Can you please introduce yourself and your role in the hospital?
2. Can you please tell me what is that you know about the patient's health record?
3. Are you involved in any aspect of the patient health records?
4. What system is used in the hospital?
5. Can you share some experience of working with manual or electronic records? (How were your duties carried out before EHR was brought into operation)
6. If the EHR is stopped in operation today, what impact will it have on stakeholders (doctors, nurses, pharmacists)?
7. How has EHR changed your work patterns? (working shifts, resources, efficiency)?
8. What are the main drawbacks of the current system?
9. What are the main obstacles to EHR adoption and implementation?
10. How was EHR introduced to you? (Did you undergo any specific training before using this version of

عوامل التمكين والتقيد التي تؤثر على اعتماد السجلات الصحية الإلكترونية في نظام الرعاية الصحية العامة الفلسطيني

إعداد

مريم سفيان علي سمارة

إشراف

د. راني شهوان

د. نضال دويكات

قدمت هذه الأطروحة استكمالاً لمتطلبات الحصول على درجة الماجستير في الإدارة الهندسية بكلية

الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين

2021

ب

عوامل التمكين والتقيد التي تؤثر على اعتماد السجلات الصحية الإلكترونية في نظام الرعاية

الصحية العامة الفلسطيني

إعداد

مريم سفيان سمارة

إشراف

د. راني شهوان

د. نضال دويكات

الملخص

السجلات الصحية الإلكترونية (EHRs) هي احد تطبيقات تكنولوجيا المعلومات الصحية (HIT) التي تهدف إلى تعزيز الرعاية الصحية العامة من خلال تقديم علاج عالي الجودة وضمان سلامة المرضى. على الرغم من الفوائد المتعددة للنظام الصحي الإلكتروني للمرضى ومقدمي الخدمات الصحية ، لا تزال هناك عقبات تحد من التبني والتنفيذ الناجح للسجلات الإلكترونية.

تستكشف الدراسة نوعياً وتحدد الميسرين الرئيسيين الذين يدعمون اعتماد السجلات الصحية الإلكترونية والعقبات الرئيسية التي تحد من تنفيذ السجلات الصحية الإلكترونية. إلى جانب ذلك ، أنشأت الدراسة إطاراً نظرياً لعوامل التمكين والتقيد.

تعتمد منهجية الدراسة على التحليل النوعي للمقابلات شبه المنظمة مع ستة وعشرين من الموظفين السريريين وغير السريريين عبر ستة مستشفيات عامة فلسطينية.

كشف التحليل عن ثلاثة عوامل تمكين وخمسة عوامل مقيدة بالإضافة إلى النموذج النظري. خمسة عوائق رئيسية تشمل قيود النظام وعيوبه ، ونقص الاتصال بين مختلف أصحاب المصلحة ، والممارسات السلبية البشرية ، وقضايا الموارد ، وعدم كفاءة النظام. تشمل الميسرات الرئيسية الثلاثة الاعتراف المعرفي تجاه نظام السجلات الصحية الإلكترونية ، والتدفق السلس للمعلومات ، والتجربة السابقة مع السجلات المكتوبة بخط اليد. توفر الدراسة أيضاً إطاراً نظرياً لعوامل التمكين والتقيد التي

تؤثر وتحد من اعتماد وتطبيق السجلات الصحية الإلكترونية عبر المستشفيات الحكومية الفلسطينية من منظور وخبرة مقدمي الرعاية الصحية.

تم تصنيف جميع الحواجز والميسرات التي ظهرت في عوامل التمكين والتقييد إلى خمسة حواجز رئيسية وأربعة ميسرين رئيسيين لتكوين فهم شامل للوضع الحالي للسجلات الصحية الإلكترونية. الحواجز المالية و التقنية و البشرية و الوقت ، بالإضافة إلى الحواجز التنظيمية ، هي الفئات الخمس الرئيسية للعوائق والتحديات التي تقيد التنفيذ الناجح للسجلات الصحية الإلكترونية. من ناحية أخرى ، فإن التجربة السابقة مع السجلات الورقية وخصائص نظام ابن سينا الالكتروني والميسرين البشريين والتنظيميين هي الفئات الأربع الرئيسية للميسرين الذين يدعمون التنفيذ الناجح للسجلات الصحية الإلكترونية.

أخيراً ، توفر الدراسة آثاراً عملية للباحثين والمديرين التنفيذيين للرعاية الصحية وأصحاب المصلحة. يُنصح المديرين التنفيذيين في مجال الرعاية الصحية وأصحاب المصلحة دعم المُيسرين المذكورين وتعزيزهم بشكل أكبر لتحقيق الاستدامة. بالنسبة للعقبات المذكورة ، يمكن للمساهمين التغلب عليها أو تقليل آثارها السلبية من خلال اتباع الآثار البحثية للتعامل مع العقبات المذكورة بفعالية. للمساهمة المعرفية ، يوصى الباحثون بالاهتمام بالدراسات المستقبلية لتعزيز واقع السجلات الصحية الإلكترونية في القطاع الصحي الفلسطيني.