College of Graduate Studies

Information Technology and Management System Department

Assessment of the Automating Levels of Pharmacy Information System Used in Hospital Pharmacy in the District of Hebron

By

Wala Ashraf Shawar

Supervisor:

Dr. Mohanad Jaabari

A Thesis Submitted in Fulfillment of the Requirements for the Master degree in Information Technology and Management System**,** College of Graduate Studies, Hebron University.

2023

Assessment of the Automating Levels of Pharmacy Information System Used in Hospital Pharmacy in the District of Hebron

By

Wala Ashraf Shawar

This thesis was defended successfully on 2023, June 7, and approved by:

Committee members		**Signature**
Dr. Mohanad Al-Jabari **Hebron University**	Supervisor	.....
Dr.Belal Amro **Hebron University**	Internal Examiner	.....
Dr. Mahmoud Alhaddad **Palestine Polytechnic University**	External Examiner	.....

Abstract

Assessment of the Automating Levels of Pharmacy Information System Used in Hospital Pharmacy in the District of Hebron

The present study aims to investigate the degree of using Pharmacy information system (PIS) and the obstacles that encounter applying it in hospital pharmacies in Hebron district, considering he effect of these variables; (hospital type, position, gender, age, work experience, and academic qualification). Structurally, the study is based on a set of criteria to classify the automation of PIS into levels. As for methodology, the study adopted the descriptive-analytical methodology on a population of Pharmacists and IT Staff working in (9) public and private hospitals in district of Hebron. Population of the study represented in comprehensive survey to include all the members in the study community equal to (52) hospital pharmacy employees. As for the instrument, for the sake of the present study, the researcher developed a questionnaire to collect the data from the participants. Validity and reliability of the instruments were verified. The study findings indicate a high degree using of levels (1) and (2) related to the PIS automation levels. Whereas, the study showed low and medium use of levels (3) and (4), respectively, the study also found that the financial constraints showed the highest constrain to hinder the development of PIS use, followed by the lack of infrastructure available in the departments to provide the required work. In addition, there were no statistically significant differences found in the degree of using PISs in the hospitals of Hebron district due to variables of (Hospital Type, Gender, Work Experience, and Academic Qualification). There were statistically significant differences due to variables of (Position and Age). It is of worth

noting here that the most remarkable recommendations are based on the increase of awareness about the importance of PIS for all professionals involved in health sector. The main recommendations for Ministry of Health is to establish a medical database for patients, link it to various private and public hospitals, and pass laws to legalize safe exchange of patient records between various hospitals. Also, the study recommends hospital administrators to conduct training courses for their staff, providing them with the best and recent practices of various electric health information systems.

Keywords: Pharmacy Information Systems PIS, Hospital Pharmacies, Hebron district.

الملخص

هدفت الدراسة التعرف إلى درجة استخدام نظم المعلومات الصيدلية في صيدليات مستشفيات محافظة الخليل، والعقبات التي تواجه تطبيق نظم المعلومات الصيدلية في المستشفيات من وجهة نظر الصيادلة وموظفي تكنولوجيا المعلومات العاملين في المستشفيات، بالإضافة إلى فحص أثر متغيرات (نوع المشفى، والمسمى الوظيفي، والجنس، والعمر، وسنوات الخبرة، والمؤهل العلمي)، في درجة استخدام نظم المعلومات الصيدلية والعقبات التي تواجه تبنيها في مستشفيات محافظة الخليل.

اعتمدت الدراسة على مجموعة من المعايير والتي تصنف نظم المعلومات الصيدلية ومدى استخدام التكنولوجيا إلى عدة مستويات. أيضاً، استخدمت الدراسة المنهج الوصفي، حيث اشتملت الدراسة على العاملين وفق مسميات (صيدلاني، وموظف تكنولوجيا معلومات) في مستشفيات محافظة الخليل التي بلغ عددها (9) مستشفيات، وتم اختيار عينة حجمها (52) موظفاً بأسلوب المسح الشامل لمجتمع الدراسة؛ ولتحقيق أهداف الدراسة استخدمت الباحثة أداة الاستبانة لجمع البيانات من أفراد مجتمع الدراسة، وقد تمّ التّأكد من صدق وثبات أداة الدراسة.

خلُصت الدراسة إلى مجموعة من النتائج كالآتي: أنّ درجة استخدام نظم المعلومات الصيدلية لكل من المستوى الأول والثاني كانت مرتفعة، فيما كانت منخفضة للمستوى الثالث، ومتوسطة للمستوى الرابع. أيضاً أظهرت نتائج الدراسة عدم وجود فروق ذات دلالة إحصائيّة تعزى لمتغيرات (نوع المشفى، والجنس، وسنوات الخبرة، والمؤهل العلمي) في درجة استخدام نظم المعلومات الصيدلية في صيدليات مستشفيات محافظة الخليل. ووجود فروق ذات دلالة إحصائيّة تعزى لمتغيري (المسمى الوظيفي، والعمر).

أبرز المقترحات والتوصيات التي خرجت بها الدراسة كانت تصب حول رفع درجة الوعي وأهمية نظم المعلومات الصيدلية لدى جميع الجهات ذات العلاقة بالجانب الصحي، فكانت التوصيات لوزارة الصحة بضرورة استحداث نظام قاعدة بيانات شامل للمرضى المراجعين للمستشفيات، وربط هذا النظام بين المستشفيات الخاصة والحكومية، وإقرار قوانين تنظم عملية تناقل بيانات المرضى بين المستشفيات المختلفة بشكل آمن بما يحفظ خصوصية المرضى ومعلوماتهم، كما وأوصت الدراسة مديري المستشفيات بضرورة تدريب الكوادر الطبية العاملين

في المستشفيات على كيفية الاستغلال الأمثل للموارد الإلكترونية المتاحة، والتدريب على استخدام نظم المعلومات الطبية بشكل عام.

الكلمات المفتاحية: نظم المعلومات الصيدلية، صيدلية المستشفى، محافظة الخليل.

Dedication

This thesis is dedicated to:

The Sake of Allah who supported me in facing all circumstances to complete this work.

My dear parents who have always encouraged me to give the best, my family, and friends.

Dr. Mohanad Jaabari, Prof. Mario Macedo, Hebron University and the staff of the Information Technology and Management System Department.

To all those who have their own dreams and insist to achieve them, the price of success is just dedication, and hard work to the things you want to see happen.

Declaration

I declare that the Master Thesis entitled **"Assessment of the Automating Levels of Pharmacy Information Systems Used in Hospital Pharmacies at Hebron"**; is my own original work, and hereby certify that unless stated, all work contained within this thesis is my own independent research and has not been submitted for the award of any other degree at any institution, except where due acknowledgement is made in the text.

Wala Shawar

ACKNOWLEDGEMENTS

This work would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

Foremost, I would like to record my deepest gratitude to Dr. Mohanad Jaabari for his supervision, advice, and guidance from the very early stage of this research, as well as giving me extraordinary experiences throughout the work.

I would like to extend my appreciation to all staff members of the Information Technology and Management System Department at Hebron University.

I would like to express my grateful appreciation and thankful to my family for all the love they provided me throughout my life.

Finally, I can't forget to thank my husband and my sweet kids

Thank you all**.**

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

List of Abbreviations

ARRA	American Recovery and Reinvestment Act
CDR	Clinical Data Repository
EDDIs	Electronic Drug-Drug Interactions
EDS	Electronic Dispensing System
EHR	Electronic Health Records
EMM	Electronic Medicine Management
EMR	Electronic Medical Records
EPMs	Electronic preparation of medicine
EPS	Electronic Prescribing Service
FEHRs	Federation of Electronic Records
GMP	General Medicine Practice
HiMSS	The Health Care Information and Management Systems Society
HIS	Hospital Information Systems
HIT	Health Information Technology
HITECH	Health Information for Economic and Clinical Health Act
IT	Information Technology
PIS	Pharmacy Information Systems
PMS	Pharmacy Management System
WHO	World Health Organization

1. CHAPTER I. INTRODUCTION

1.1 Study Background

The constant revolution of Information Technology (IT) has made significant changes in various aspects of our life. Health-care sector has been mostly affected by such technological advancements. Since patients' healthcare must be well-looked-after, not compromised; it becomes crucial to develop, maintain, and assess the modern information systems in parallel with the developments in medical devices and robots for healthcare benefits. (Alanazi, et al, 2018)

In fact, the recent developments in the field of medical technologies have increased patients' expectations showing a growing indispensable need for the use of information systems in hospitals (Alanazi et al, 2018).

It is worth noting that information systems play a significant role in management because computerizing job tasks in an effective manner and getting rid of the complications of paperwork can improve the quality of health care services. This means requiring less time, eliminating redundancy, redacting the number of medication errors and consequently, enhancing patients' safety. (Saghaeiannejad-Isfahani, et al 2015 & Khudhur, 2018)

Actually, computers have been used in pharmacies for a long period time to manage medical supplies by keeping separate patients' and medicines' records and documents. Remarkably, the development of Pharmacy Information Systems (PIS) to support working processes in both hospital and community pharmacy has taken place in the UK, US and other countries since 1980 (Goundrey-Smith, 2012). Theoretically, PIS is a computer information system used for managing and storing medicines in the pharmacy and linking its system with other related systems. These systems are currently taking over from the typical manual or paper-based systems. Computerized systems indicate highly efficient functions such as; stock management, control and medicine labeling ...etc. (Khudhur, 2018)

PIS is also a sub-system of the hospital information system, which helps pharmacists manage medication services, improve financial management, and increase scientific knowledge about therapies and medication utilizations. (Alanazi et al., 2018)

Numerous studies were conducted around the world for a better understanding of the current state of pharmacy practices, mainly in hospitals, identifying key issues facing it, and designing improvement strategies. Furthermore, findings of the studies were partially or entirely adopted in developed and developing countries to leverage the infrastructure to support pharmacy practices. (Chamoun et al., 2020)

Pharmacies classify clients' care into; inpatient and outpatient. While the former requires a patient to stay in a hospital overnight, the latter does not. Inpatient PIS is more complicated than the outpatient counterpart, since it primarily depends upon the active and continuous communication with various hospital departments, service providers, and technicians. So, inpatient pharmacy staff is required to communicate with physicians, nurses, and other hospital staff to ensure that benefits of the system; such as reducing medication errors and providing high quality patient care, are implemented. (Alanazi et al., 2018)

The evaluation of PIS, as a key stage in the information system development life cycle, represents, on the one hand, a critical point for decision maker to make decisions related to the implementation, modification and utilization of the PIS. On the other hand, to evaluate the abilities to connect with hospital information systems in an integrated information system that links all systems with each other. (Kazemi, Rabiei, Moghaddasi, & Deimazar, 2016)

Many studies have classified PIS into multiple levels with specific criteria for each. The assessment of the pharmacy system is a key point for this classification. The percent study adopted seven levels of classification listed below- (see: 2.1.5):

- Electronic Medicine Management (EMM)
- Electronic Prescribing Service (EPS)
- Electronic Drug-Drug Interactions (EDDIs)
- Electronic Drug-Disease Interaction

- Electronic Dispensing System (EDS)
- Electronic preparation of medicine (EPMs)
- Online Pharmacy.

Considering these levels beside the lack of academic studies on evaluating the reality of using PIS in Palestinian hospitals' pharmacies, the present study mainly aims to investigate the appliance of the PIS first four levels in Palestinian hospitals' pharmacies. The other three levels are not addressed in this study due to the lack of the necessary technical infrastructure in the Palestinian Hospitals.

1.2 Problem of the Study

The Palestinian health sector witnesses many problems resulting from the weak infrastructure of health facilities and hospitals in general. These troubles showed an increase upon the outbreak of the Corona pandemic, which evacuated hospital wards for the sake of treating Covid-19 infected cases or patients. (Samara, 2021)

Similarly, pharmacies worldwide suffer from many problems like; medical errors like finding expired drugs in pharmacies. Drugs interaction probably causes serious side-effects, and the misunderstanding of the hand-written prescriptions and reports. In addition, the availability of medicines can be challenging, for it becomes hard to track the drug store permanently and comprehensively to ensure that there is sufficient and permanent stock and to track and find expired drugs in the pharmacy (Crowley & Stellenberg, 2015).

Actually, the health sector in the district of Hebron is still encountering the limited number of hospitals with under-estimated capacity, still inadequate to respond to the ever steady increase in the number of the patients. This continuous increase puts a huge pressure on the part of the inpatient pharmacy. And despite the frequent developmental plans that the health-care administrations in Hebron follow to avoid some problems, there are still problems, and difficulties hindering the providence of the hopefully expected services (Jabareen, et al, 2020).

The study statement of problem is evolved from two main sources. The first represents variety of the researcher observations indicating that the majority of government and

private health suppliers in the district of Hebron still apply the traditional paperwork systems in their management of patients' records, the matter that leads to a wide range of errors. The other source of the study statement of the problem represents local and regional studies clarifying the significance of improving HIS and PIS, accordingly, (WHO, 2019) empathized the necessity to evaluate the current health systems towards strengthening and improving them, generally for the benefit of the health sector. Other related studies and conferences; focus on the PIS in particular. Among these is (Alanazi et al, 2018) who demonstrates the idea of maximizing the benefits of PIS, importantly assessing its impact on pharmacists' workflow and all other processes of the medication system.

1.3 Questions of the Study

This study investigates the degree of using PIS in hospitals' pharmacies in the district of Hebron. Therefore, it attempts to answer these two main questions: (1) "**what are the evaluation mechanisms used to evaluate the PIS?"** and (2) "**to what extend do hospital pharmacies in Hebron district use automated pharmacy Information System (PIS)?**". In other words, the study aims to evaluate the levels of PIS used in the hospital pharmacies in Hebron district.

Here are also other study main questions:

1. To what extent do hospital pharmacies in Hebron district use the automated Pharmacy Information System (PIS)?
2. What are the challenges and obstacles that face the development of using the electronic PIS in the district of Hebron?
3. Are there any statistically significant differences at the level ($0.05 \geq \alpha$) between the averages of the study sample's estimates of the degree of using PIS's in the hospitals of Hebron District due to variables (hospital type, position, gender, age, work experience, and academic qualification)?
4. Are there any statistically significant differences at the level ($0.05 \geq \alpha$) between the averages of the study sample's estimations of the obstacles to the development of

PIS's in the hospitals of Hebron District due to variables of: (hospital classification, position, gender, age, work experience, and academic qualification)?

1.4 Objectives of the Study

In this section, objectives of the study are listed aiming:

1. To investigate the degree of the first four levels of the PIS used in hospital pharmacies in district of Hebron.
2. To discuss the current situation of the PIS used in hospital pharmacies in Hebron district based on PIS levels.
3. To identify the main problems facing hospital pharmacies in Hebron district utilizing modern methods of work.

1.5 Significance of the Study:

The present study gains its significance from the importance of the health sector to human lives and its influence on other sectors in general. Such significance of the study will be indicated according to these categories:

1.5.1 Scientific and Academic Significance:

1. Rising awareness of the term (PIS) and its major factors and introducing its roles to overcome current problems in the daily works in hospital pharmacies.
2. Highlighting some of modern PIS's models and their applications, programs and tools.
3. Submitting recommendations to carry out further relevant academic researches based on the results of this study.

1.5.2 Significance for the Ministry of Health:

Significance of the study regarding the importance of the ministry of health refers to its responsibility to take actions and set new regulations to organize and develop this sector. More importantly, the researcher hopes that the results and recommendations of

the study will contribute to draw an accurate image of the current status of PIS, so that the ministry can take the necessary actions to achieve real advancement.

1.5.3 Significance for Hospitals:

1. Provide an accurate perception to the local hospitals in Hebron district about their current PIS and further recommendations for developing the systems.
2. Indicate the most important obstacles and problems that prevent the optimal use of PIS.
3. Point out the medical errors that can be avoided when using PIS.

1.5.4 Importance for Patients:

Raise awareness among patients about the importance of having PIS in hospitals to avoid medication errors and raise the quality of the services provided.

1.6 Limitations and Challenges of the Study

The research faces many limitations as follow:

1. Lateness of giving the ministry's permission to distribute the questionnaire
2. Weakness of the response of the study sample.

1.7 The Study Definitions

Pharmacy: is the health profession that has the responsibility for ensuring the safe, effective and rational use of medicines. (Moullin, et al, 2013)

Information system: an integrated set of components for collecting, storing, and processing data and providing information, knowledge, and digital products. (Zwass, 2020)

Pharmacy Information System (PIS): is a sub-system of the hospital information system, designed around acute care services, and is useful in implementing many pharmaceutical care models. (Alanazi et al., 2018)

1.8 Organization of the Study:

This study is consisted of five main chapters; the Introduction, theoretical framework and literature review, methodology, results & discussion of questions, conclusions and future work. Following is a brief on the chapters:

Chapter I. Introduction:

It introduces an overview of the research background, formulation of statement of the problem, significance of the study to the different categories, limitations of the study challenges, in addition definition of the title terms and finally the study structure organization.

Chapter. II. Theoretical Background and Literature Review:

It overviews two major titles; (1) the theoretical frame work with detailed description of the study dimensions and links, and (2) the previous studies.

Chapter. III. Methodology of the Study

It defines methodology of the study, population of the study, sources of data collection, data collection tools, and the statistical analysis method.

Chapter. IV Results & Discussion of Questions of the Study

Basing on the statistical analysis of the research tools, discussion of the research question and the final results are introduced here.

Chapter. V. Conclusion and future Works

It mainly concludes and lists the main results, recommendations and future work.

2. CHAPTER II. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Theoretical framework of the study is an important part of conducting research as it helps researchers to extend their understanding of an academic viewpoint of the topic and build their research on a solid background.

2.1 Theoretical Framework of the Study

2.1.1 Introduction

Information systems are the integration of a set of components through which data is collected, stored and processed to provide the information that supports decision makers to appropriately decide.

Using information systems has become indispensable for companies and institutions as they need such systems in all aspects of management, interaction with customers and suppliers, and in facilitating competition in the market, too. These systems are also required in the operation of supply chains which link organizations and electronic markets. (Kazemi et. al, 2016)

To clarify this, companies use accounting information systems or information systems to manage human resources to reach their potential customers. Through online promotions, huge companies seek services that are built around information systems, e.g., e-payment, Amazon, Alibaba, and Google. (Van der Aalst, et al, 2019)

Similarly, individuals around the world use information systems for social communication, shopping, banking ...etc. The inventions and technologies that help record and process information over the past decades have enabled individuals to make greater use of information systems. These technologies help governments to facilitate people's lives in various forms as well. (Van der Aalst, 2019)

Information systems have a profound impact on society by accelerating the pace of daily activities, and providing more new opportunities (Zwass, 2022). In addition,

Information systems have influenced organizations in all aspects including quality of products purchased also due to the progress in information systems.

However, the development of information systems has led to threats that have not existed before, especially with regard to protecting patients' privacy, and maintaining the confidentiality of their medical records in parallel with sharing these records with other relevant medical authorities to provide the best service to patients. (Zwass, 2022).

2.1.2 The Components of Information System

Information systems' components can be divided into two parts, the first is related to technology, which includes hardware, software, data, and communication networks. The second is individuals and processes. Both can be explained as follows: (Bourgeois, Smith, Wang, & Mortati, 2022)

2.1.2.1 Technical Components of Information Systems

Technical components make an integration of the following:

1- The hardware which belongs to any part that can be touched, such as computers, their accessories, and networks.
2- The software which is the set of instructions that control the hardware according to the user's commands. The software can be an operating system software, such as, Windows or application software, word processing programs and tables. (McKelvey, et al, 2016 and Bourgeois, et al, 2022)
3- Data refers to the facts that, if processed, will be of great use. Provided that, information systems process data, it becomes valuable kind of information for many individuals or collective decision centers.
4- Communication networks that represents the basic technology for information systems, especially after the advent of the Internet. Yet it does not mean that information systems did not exist before that. (McKelvey, Tanriverdi, & Yoo, 2016)

2.1.2.2 Non-Technical Components of Information Systems:

The nontechnical component of information system has two elements. First is he human element (people) who are the staff involved in the information systems, and all other workers or employees that contribute to the operation an use of the information system in terms of hardware or software? Here, humans include the assistant staff, the systems analyst and information officer in chief .The second component refers the process or processing, which is a series of steps conducted to reach a specific result. To put it differently, the process is a set of procedures taken to open an account on e-Pay, and the process of transferring files through the network of information systems available in any institution like banks...etc. (Bourgeois, et al, 2022)

2.1.3 Health Informatics and Health Information Systems

It is necessary to differentiate between informatics, information management, and information technology. While informatics is the real application to improve the task performed by information management within an organization, information management refers to the thought of ensuring the safety and availability of information inside and outside the organization. Generally, Information technology includes the devices- computers and their accessories that handle, connect, and store information. (Jabareen, et al, 2020)

Information systems are a set of components that collect, retrieve, process, store and distribute information to facilitate the tasks of planning, control, and analysis. And accordingly, make the appropriate decision on the right time. So, the information system becomes among the most important elements for an organization success. (Hoyt, & Yoshihashi, 2014)

Oral or recorded health information is any health information related to any entity that provides health services in general. Whereas, health informatics indicates more comprehensive role whereby computer applications are applied through networks to process, store, and instantly and accurately display health information. This is likely

concerned with all branches of health (bio-medicine); dental, nursing, clinical, pharmaceutical...etc). (Carroll, & Richardson, 2020)

Health Information Technology (HIT) is the technology that electronically manages and shares patients' information, rather than paper recordings. Implementations can be carried out through important technologies such as electronic medical records (EMR) or electronic health records (HER). Placing computers in examination rooms and using smartphones are also recommended to be part of the system. (Hoyt, & Yoshihashi, 2014)

2.1.4 Health Information for Economic and Clinical Health Act (HITECH)

HITECH aims to raise the level of American health care and patient care through providing excellent information technology work and is part of the American Recovery and Reinvestment Act (ARRA). This system is originally designed to provide support and technical assistance to the public health community in countries, i.e., establish communication between countries for emergencies to enable coordination and harmonization through cadres trained and equipped to operate electronic records.

2.1.5 . Electronic Medical Record (EMR) and Electronic Health Record (EHR)

The EMR system was established by (Health Insurance Portability and Accountability) to substitute patient's paper-based record system when receiving health services. Whereas the EHR is the patient's electronic health record by which the information is recorded for to be displayed and used in various places where health care can be provided. Records also represent information about patients' health care providers and institutions. Clearly, such information can be used nationally or internationally (Ta, 2022).

2.1.6 Shareable HIS based-on EHR

Health care institutions; hospitals, medical centers, clinics, laboratories, etc., do not use the sharing method for patient records to extend data, and therefore information share requires the use of electronic records that were purposefully created for this sake.

Sharing HIS has several levels; mainly on an institutional, national, or the international levels. The HCI and (HIMSS) defined it in the form of a model within eight levels, as follows (Furukawa, & Pollack, 2020):

Level 0: at the health institution, they do not provide information systems in the laboratory, pharmacy, and radiology, and therefore paper records are still used to store and access into clinical information.

Level 1: The health institution at this level installed the three systems mentioned in level (0) so that its records are turned into electronic system.

Level 2: Major clinical systems feed their data to the Clinical Data Repository (CDR), which is available for the clinician to review with its controlled medical vocabulary and rules that support clinical decisions to initially recognize the disease.

Level 3: Electronic messaging in which computers have taken over from paper charts; clinical documentation and clinical decision support.

Level 4: The most prominent aspect of this level is the implementation of the electronic patient system or the main index system for the patient so that the radiology information system can be accessed via Internet.

Level 5: It allows physicians to get access into medical images over an intranet and overlays all film-based images across a full set of RIS systems.

Level 6: Full physician documentation with structured templates and discrete data is implemented for progress consult notes, discharge summaries, or problem list and diagnosis list maintenance.

Level 7: Reaching this level means that the hospital no longer uses paper-based record to provide and manage patient care, and therefore the data has the most analysis that improves the quality of health care and patient safety. Besides, private data of each patient is also shared with many relevant authorities, including Mobile clinics, as an

example, blood products, and breast milk are included in the closed-loop drug administration process.

2.1.7 Hospital Information System (HIS)

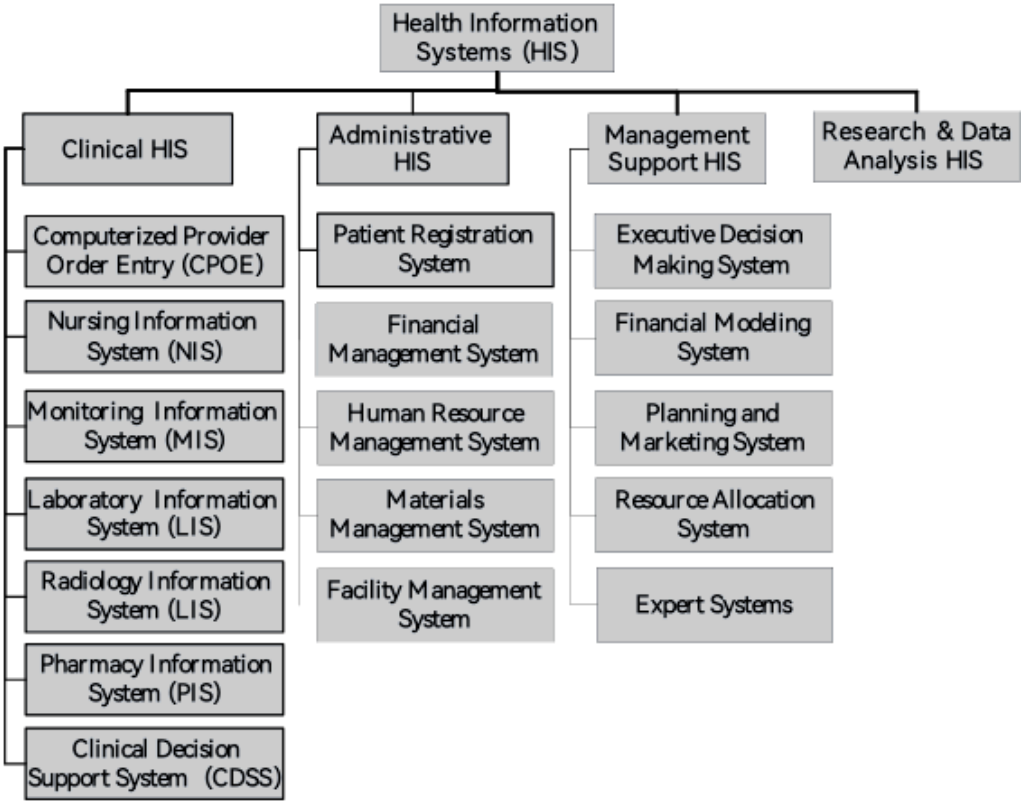
Computers are used in hospitals to carry out a wide range of activities, mostly, data processing and storage to support daily operations and facilitate the tasks associated with the staff responsible for their accomplishment. All of these systems are called Hospital Information Systems (HIS), which may, exclusively in some countries, be extended to include internal and external operations associated with patients' hospital or even home care. In some countries. (Mimi, 2015)

The most important functions that HIS supports are Medical Data Processing, including all health facilities in hospitals, like; patients' registration, acceptance, and transfer of their data to ensure the preservation of their numbers and any other notes related to their health status. HIS also helps managing patients' financial accounts utilizing other hospital facilities such as laboratories, pharmacies, and warehouses. (Balloni, 2011)

HIS consists of various categories (see Figure.1 below); clinical HIS, administrative HIS, Management support HIS, and Research and development. Each of these is also subdivided into subsystems. The Clinical HIS, for instance, over-control the Pharmacy Information System PIS, which includes the activities of preparation, distribution, and creation of prescription labels, in addition to stock control. (De Souza, et al, 2016)

Finally, it is clear that the integration of these systems through a computer network can help hospital to save time, efforts, and money fin all types of activities they perform. (Tropp, 2003)

Figure 1: *Basic Hospital Information System (HIS) software Segments.*



Prepared by the researcher based on (de Souza, TOMAZELLI & de Vasconcelos, 2016; Balloni, 2011)

This study focuses on PIS under the clinical HIS section.

2.1.8 Pharmacy Information Systems

Like any computerized system, PIS provides the availability of an electronic infrastructure which aims to support and manage pharmacy services; so as to track the use of medicines and the follow up the workflow in the pharmacy. Besides, PIS along with other systems works to fulfill these needs. (Kagoya, et al, 2020)

The use of any computer information system increases the flexibility of the process of work whether it is traditional or computerized. Therefore, the PIS contributes in reducing medication errors, and increasing patient care and safety. PIS is categorized according to the type of patients into two types. First, outpatient PIS that is concerned with home environments of the discharged patients. Second, inpatient PIS which is

concerned with residents patients. Despite the great similarity between the two types, research has shown that inpatient PIS is more comprehensive than outpatient PIS as it has a clearer drug labeling, drug tracking, warnings, and instructions (Hardy, 2008, Goundrey-Smith, 2013).

2.1.8.1 Features of the Pharmacy Management System

PIS, also the Pharmacy Management System (PMS) or Pharmacy Software, is a system that stores complete information about the pharmacy procedures and processes. It helps store data, organizes the entire system, controls medication use, and improves customer satisfaction. **Following are** the features of this system:

2.1.8.1.1 Prescription Management

Both the pharmacist and patient find difficulty in reading and understanding hand-written prescriptions, the matter that may cause confusion. In addition to the presence of illegal prescriptions, i.e., taking the wrong medication, to avoid any misunderstanding, confusion and medical errors, the pharmacy management program exempts the pharmacist from reading the prescription, as it is stored in records and thus repeating the medication when needed.

2.1.8.1.2 SMS and Alerts

The pharmacy management program allows the pharmacist and patients to get instant regarding different situations or services for a better pharmacist-patient relationship. For example, patients' medicine renewal, nearly out of stock drugs, schedule regular appointments via SMS to help patients comfortably receive services and the date of the next medication at the same time.

2.1.8.1.3 Reporting

Reporting the process of work is important in any business because well-prepared reports and data analysis necessarily lead to make right decision at the right time. In a pharmacy, there are many daily processes; sales managers, patients, doctors, medical representatives, etc. So the pharmacy management program allows storing, analyzing, and organizing all the daily processes. To clarify this, reports highlight different aspects

that require improvement and help to put together the appropriate and needed remedial plans and methods.

2.1.8.1.4 Expiry Management

As statistics indicate, pharmacies incur big losses due to the expiration of stored medicines leading to disposing them. Pharmacists, reducing such loss can be achieved by speeding up selling them or returning them to the suppliers. (Singer & Duarte, 2015)

2.1.8.1.5 Re-Order Management

The pharmacy management system allows identifying points that are not in order it also notifies the need for refilling the stock, and recognizes the most or least preferable products. This helps the pharmacist sets the minimum and maximum limits for any product according to its frequency of demand or use.

2.1.9 Computerization of Pharmacy

The pharmacy computerization process is classified into levels showing that some pharmacies have achieved advanced stages while others still struggle lower. (See Table.1).

Table 1: *The Seven Levels of PIS*

No.	Level	Description
1	**Electronic Medicine Management (EMM)**	It focuses on managing the department of pharmacy (Medicine labeling, pricing, ordering management, stock control, orders tracking, medicine description and invoice)
2	**Electronic Prescribing Service (EPS)**	It focuses on electronic generation, transmission and filling medical prescription (electronically fill prescription and transmit the prescription to PIS)
3	**Electronic Drug-Drug Interactions (EDDIs)**	It focuses on helping clinicians or pharmacists to identify and prevent clinically significant drug interactions or unexpected side effects.

No.	Level	Description
4	**Electronic Drug-Disease Interaction**	It focuses on helping clinicians or pharmacists to identify and prevent clinically-significant drug- Disease interactions
5	**Electronic Dispensing System (EDS)**	It focuses on using a computer, a network connection, and a drug-dispensing unit to allow physician and patients to obtain medications outside traditional pharmacies (Outpatient & Community Pharmacy, Hospital Inpatient Pharmacy, Tele-pharmacy)
6	**Electronic preparation of medicine (EPMs)**	It focuses on technological platforms to create medicine on order and direct composition of medication.
7	**Online Pharmacy**	It is the pharmacy that operates over the Internet and sends / receives orders via the mail or shipping companies.

Prepared by the researcher based on (El Mahalli, El-Khafif, Yamani, 2016; Singer & Duarte, 2015)

2.1.9.1 Electronic Medication Management (EMM)

The use of the Electronic Medicines Management (EMM) system leads to an improvement in the quality, safety, and efficiency of medication management within the hospital environment. In other words, prescriptions, monitoring, modification, dispensing, and recording of medications can be done digitally so doctors, pharmacists, and nurses can obtain the needed information.

The main purpose of the Electronic Medicines Management System (EMM) is to organize medicines management within the treatment cycle. It is managed by nurses, which starts from the doctors prescribing drugs to patients, reviewing the prescription, and dispensing it from the pharmacist.

According to the previous studies, the most negative point of the EMM system, though it was designed to reduce medication errors, is that it is not designed or implemented, or

its resources are cut in an elaborated, studied, and tested manner. (Australian Commission on Safety and Quality in Health Care, 2012)

2.1.9.2 Electronic Prescription Service (EPS)

Electronic Prescription service (EPS) provides electronic prescription of the pharmacy clinic, and to the pricing authority for payment. In addition, it was developed in two versions; the prescription, the electronic prescription and disbursement of medicines.

The Electronic Prescribing Service (EPS) system is important in reducing social contact and protecting patients, emerged during the Corona pandemic. It reduces the number of visits to general practitioner (GP) and reduces waiting times at the doctor's desk in pharmacies.

2.1.9.3 Electronic Drug-Drug Interactions (EDDIs)

Although medications are an important part of healthcare intervention due to their health benefits, the use of these drugs may be associated with problems estimated at 1.5 million drug adverse effects and thousands of hospital admissions. Drug-drug interactions (DDI) is recognized as one of the main causes of a high relapse rate of patients' health, which may end up with patient's death.

Electronic Drug-Drug Interactions (EDDIs) aims to prevent unwanted interactions that negatively affect patients and may cause serious side effects.

EDDIs, however, in various countries, face lack of national standards for DDIs which is run routinely in these systems. For the success of this system, the DDI lists must be reviewed from more than one source of the leading health systems (Classen, Phansalkar, & Bates, 2011).

2.1.9.4 Drug-Disease Interaction

Drug-disease interactions can either increase the drug's desired effect or increase potential risk to patients getting the drug. Thus, these drugs must be avoided or modified, and monitored by the way. Studies have shown that there is a lack of evidence

to explain and translating features of the products. Actually, this might lead to inappropriate results. Further, many studies have recommended sets of standardized drug-prescribing formulation in accordance with the sights of both experts and previous studies. (Van Tongeren, et al 2020).

2.1.10 The Health Environment in Palestine and its Relationship to PIS

Establishing an electronic health record system in Palestine faces many challenges in spite of all efforts made in this regard. Actually, the applied health record system might be extended to suit well a future PIS in Palestinian hospitals (Mimi, 2015).

The WHO's accreditation of electronic health records (EHRs) state the challenges of establishing a health record system in Palestine. They indicate that middle or low-income countries do neither comply with the international system, nor with the requirements of the Federation of Electronic Records (FEHRs). So, the problems continue due to the lack of resources and the weakness of economy. (AlDweik, & Ashour, 2010)

Palestine is considered as one of the low-income countries with a population of about 5 million people, divided into about 3 million in the West Bank and 2 million in the Gaza Strip. While the total Palestinian government spending on the health sector did not exceed 1.4 million US dollars, which is equivalent to approximately 10% of the gross domestic product, the percentage of government spending does not exceed 37%, and the rest of the spending is borne by insurance companies, families / out of pocket, and non-profit institutions. (AlDweik, & Ashour, 2010)

International statistics indicate that Palestinians live just below the poverty line. Nearly half of the population needs humanitarian assistance, and more than a million people lack food security. Along with the patients', doctors' and ambulances' mobility throughout the Palestinian territories is affected by a number of obstacles. For example, the spread of Israeli occupation checkpoints and the segregation wall, which makes Palestinians to struggle moving through the Westbank territories. Such reasons emphasis the importance of creating a model that enhances an effective infrastructure of

electronic health records, considering that as a priority for the health sector. (Samara, 2022; Jabareen, et al, 2020)

In fact, founding a health information system in Palestine will enable the medical staff and the others concerned to mutually share patients' data and achieve a strategy that complies with the WHO protocols. According to health data, Health Information Systems (HISs) are operated in the health sector in Palestine including governmental and non-governmental institutions. All of these are usually run by the Palestinian government. Unfortunately, it is not possible to make institution-institution share of the systems and likely exchange information, but only possible within the same institution. In other words, it seems not possible for these parties to mutually share the patients' e-health records. (AlDweik, & Ashour, 2010)

Finally, having all the challenges in mind, Palestine needs to step on forward seeking more development in the health information systems. This might provide solutions by adapting the existing systems, following modern standards of technology at the lowest possible cost. The PIS dimensions and levels proposed throughout this study seem to be part of the health information system. Accordingly, the system adopted in the ironing sector can be proposed the health institutions to it in terms of infrastructure, administration and finance. (El Jabari, et al, 2020)

2.2 Literature Review

Many studies have focused on the present study subject, correlating directly or indirectly. The following are reviews of the most important related studies.

2.2.1. (Al-Asafra & Amro, 2022) "Towards Secure Interoperability of EHR among Healthcare Organizations in Palestine"

This study aimed to determine the current state of interoperability in private and public healthcare sectors and to explore the compatibility level of interoperability between them. It also aims to explore the obstacles of implementing interoperability in both private and public healthcare sectors in Palestine and finally to suggest a framework for safe interoperability between different systems.

The mixed method approach (qualitative and quantitative) were used to achieve study objectives. Population of the study consisted of the employee of five Palestinian hospitals in Hebron and Ramallah (Al-Ahli Hospital, AlMeezan Hospital, and the Alia Public Hospital, Palestine Medical Complex and the Istishari Arab Hospital), whereas, the sample consisted of (140) participants.

The main study result shows that there is no electronic exchange of EHRs between private and public healthcare facilities. It is also of significance to highlight the necessity of putting interoperability into practice to enhance the quality of healthcare in Palestine. So, the researcher main recommendation provided as a suggestion to adopt a global framework named UXP/ X-Road to the process of interoperability between private and public hospitals in Palestine.

2.2.2. (Kagoya, et. Al., 2020), "Does pharmaceutical information systems data inform decision-making in public healthcare? Utility of a national system in a limited resource setting".

The study aimed to assess the extent and predictors of utility of PIS data in public healthcare in Namibia, and to identify strategies to optimize utility of PIS data in public healthcare in resource-limited settings. Quantitative and qualitative data was collected

using semi-structured questionnaires and interviews with the users of PIS systems at all public health facilities in Namibia.

The study found limited utility of PIS data in public healthcare facilities in Namibia, also quantitative predictors for the utility of PIS data for public healthcare in Namibia were (sex, age, experience, receive of feedback on PIS data, technical expertise, and managers consulting). Main recommendation of the study was to enhance capabilities for utilization the automated real-time pharmaceutical information decision support systems to enhance real-time analysis and feedback on medicines data in resource-limited setting.

2.2.3. (Carroll & Richardson, 2020) "Enablers and barriers for hospital pharmacy information systems"

The study aimed to identify the enabler factors in addition to the barriers within hospital pharmacy services. The study was particularly interested in how the pharmacy information system works and which drawbacks that prevent these improvements.

The study is classified as a qualitative one, and adopted an ethnographic approach, observing and interviewing pharmacists, pharmacy staff and nurses. The study was carried out in both governmental and private hospitals,

Study results listed the major enablers and barriers, as follow. There are five key enablers; (1) the need for pharmacy informatics, (2) a national pharmacy strategy, (3) empowerment of pharmacists, (4) medicine management and (5) pharmacy workflow. Yet, there are three key barriers namely; (1) barriers to innovation, (2) cost of pharmacy inefficiencies and (3) measuring to manage pharmacy services.

2.2.4. Farzandipour, et al (2017)

"Functional Requirements of Pharmacy Information Systems in Hospitals"

The study was conducted to determine the requirements of the pharmacy information systems. It adopted a descriptive, cross-sectional method, with an applied nature applied

to 15 hospitals. The sample consisted of (50) experts in PIS systems within the selected hospitals.

The results make suggested a list of the most functional requirements of PIS. The list revealed as; (1) making direct connection with computerized provider order entry, (2) calculating drug dosage and warning about drug interference, (3) apply barcode technology, (4) registering expiration date, way and place of keeping goods.

2.2.5. El Mahalli, El-Khafif, & Yamani (2016)

The "Assessment of Pharmacy Information System Performance in Three Hospitals in Eastern Province, Saudi Arabia"

This study aimed to evaluate the PIS in three hospitals in Eastern Province, Saudi Arabia including; King Fahd Hospital of the University–University of Dammam (KFHU), Dammam Central Hospital (DCH), and King Fahd Specialist Hospital in Dammam (KFSH-D).

The study design shows a cross-sectional, paper-based survey, and its consisted of all of PIS users; physicians, pharmacists, and nurses working for the three hospitals. A convenience sample of study population included the employees who were available at the time of data collection.

Main result of the study showed that although most PIS features were available in the study settings, adoption rates of different functionalities most or all of the time were generally low.

Finally, the study came out with several recommendations, with the most importantly was training the staff to use the PIS system and giving them enough time to do that.

2.2.6. Isfahani, Mirzaeian & Habibi, (2013)

"Assessment of Pharmacy Information System Performance in Selected Hospitals in Isfahan City During 2011"

The study aimed to evaluate the performance of pharmacy information system in three types of teaching, private and social affiliated hospitals. This study is an applied, descriptive and analytical study.

The study population consisted of all the users of pharmacy information systems in (19) hospitals in Tehran, also making the study sample. Researchers collected data using a self-designed checklist developed following the guidelines of the American Society of Health-System Pharmacists, Australia pharmaceutical Society and Therapeutic guidelines of the Drug Commission of the German Medical Association.

Pharmacy information system was found to be semi-automated in (16) hospitals and automated in the other (3). Regarding the standards in the guidelines the highest rank in observing the input standards belonged to the Social Services associated hospitals. While teaching hospitals gained the highest score in both processing standards and output standards. However, the private hospitals had the lowest mean scores in input process and output standards.

Main recommendation of the study suggested the establishment of a teamwork of; operational managers, computer fields' experts, health information managers and pharmacists as well as physicians to promote the capabilities of pharmacy information system enabling it to focus on health care practitioners and users' requirements.

2.2.7. Allaf, 2009),

: "Pharmacies and medication information systems in Jeddah City, Saudi Arabia"

The study aimed to shed light on the problems facing doctors, pharmacists, and relevant authorities in prescribing, dispensing, and supplying medicines. In addition, it aimed to evaluate the effect such problems on health services. Moreover, it aimed realize the current situation of the role of information communication, technology and information systems in improving the quality of this vital part of healthcare.

The study applied a mixed method, depending on a questionnaire and structured interview to collect data from physicians and pharmacists in the governmental, private, public health sector, and MOH and Medication Companies in Jeddah and Riyadh cities.

Results of the study, in consequent, confirmed that the health sectors within the study limitations, lack information technology, in addition to weakness in the communication systems required in information transfer and helping in the providence of medicines.

The study showed that the majority of participants confirmed that there is a lack of electronic information from doctors related to verifying drug interactions during prescribing, as well as patient safety. They also stressed that it is not possible to use the computer to obtain information about medicines and patients, and there are no electronic communication systems with other health sectors.

In private hospitals, the study showed that the largest private hospital uses information and communication technology for patients' admission, initial medical files, and prescriptions. Internally, some government sector hospitals have started using this technology.

The most important recommendation of the study is to make some changes, whether internal or external, in the Ministry of Health, particularly in departments of planning and infrastructure development. It is also recommended to conduct staff training regarding the uses of information and communication technology.

2.2.8. Mahoney et. al. (2007)

"Effects of an integrated clinical information system on medication safety in a multi-hospital setting"

This study aimed to highlight the implementation of vendor-based integrated clinical information technology consisted of computerized physician order entry, pharmacy and laboratory information systems, and clinical decision-support systems (CDSSs), electronic drug dispensing systems (EDDSs) and a bar-code point-of-care medication administration system. It also aims at evaluating its effect on medication errors throughout the medication-use process in a health care system.

The hospitals involved in the study population are part of the Lifespan health care system. These include Rhode Island Hospital (RIH), the Hasbro Children's Hospital and The Miriam Hospital (TMH).

The results indicated the positive effect of this integration on reducing the rate of medication errors during the period of medication use. In addition to, it showed a decrease in prescription errors related to drug sensitivity, excessive doses, and unclear orders. The modifications to prescriptions also witnessed decrease on a high rate. Finally, there was a positive effect on decreasing errors related to drug administration carried out by scanning the electronic barcode for every 100,000 planned doses.

2.2.9. Murray et. al., 1998

"Effects of Computer-based Prescribing on Pharmacist Work Patterns"

The study aimed to measure the effect of computer-based outpatient prescription written by internal medicine physicians on pharmacist work patterns

The study adopted the experimental method, conducted at the General Medicine Practice (GMP) and the outpatient pharmacy of the Regenstrief Health Center, the primary outpatient facility of Wishard Health Services, and Indianapolis, Indiana. It depends on work sampling at a hospital-based outpatient pharmacy. The data were collected from pharmacist pre-and-post-implementation of computer-based prescription.

The study measures the type of activities that pharmacists carry out and the jobs that perform these activities, in addition to measuring the process of communication that took place with the people associated with them.

Study main results showed that the total working hours of the employees and the prescriptions were similar before and after prescribing medications using the computer. The pharmacists recorded 4,687 pre-prescription notes and 4, ones for outpatients using the computer. The results also showed that pharmacists spent more time correcting the prescriptions written by the computer and less time-wasting and discussions with others. As for filling prescriptions, the time was 34.0% less, 45.8% went to solving problems

with the prescriptions themselves, and less time was given to providing advice. Finally, the results showed that 80% of a pharmacist's time working alone before and after using a computer goes to writing prescriptions.

2.3. Summary of the Previous Studies

The most important findings of the previous studies are as follows:

- Some studies focused on showing the importance and impact of applying pharmacy information systems, and came out with a clarification and limitation in the use of this system. They also revealed that many countries showed considerable increase in the use of this system with likely greater attention to the private sector than the public sector (governmental). This actually promote some researchers to recommend the change of old systems replacing them with new integrated systems, being suitable for the employees to get trained on.

- Some studies focused on the time used in treating medicines in hospitals, as they aimed to verify the effectiveness of an integrated information system for drug management in hospitals, and thus indicate the changes that will occur to the quality of work if this system is applied.

- Some studies focused on identifying criteria that can be used in evaluating the PIS. They came out with results indicating a lack of interest in applying a drug management system in hospitals. Other studies considered that the application of two of these criteria can restrict errors.

- Some studies focused on the services provided by PIS within the geographical limitations of these studies to compare the importance of use and confirmed the existence of some levels of PIS use in all hospitals. Yet, not all of them reached the levels that prevent the integration of these applications.

- Some studies have focused on the issue of compliance with the globally applied standards in PIS, and found discrepancies in their application in the health sectors in general. In that the application and integration of these standards will reduce errors in all forms to the minimum.

3. CHAPTER. III. METHODOLOGY

3.1 Introduction

This chapter provides a comprehensive description of the methodology and procedures followed by the researcher to answer the research questions and achieve its objectives.

Chapter three actually illustrates the applied methodology and reasons for choosing it, the population and the sample of the study. The chapter also sheds light the data collections primary and secondary instruments. Later on, validity and reliability tests for the primary instrument are stated. The final part of the chapter presents the design of the study and its structure, a statistical analysis and the study ethical considerations.

3.2 Methodology

This descriptive, quantitative and qualitative study aims to investigate the reality of using automated Pharmacy Information System (PIS) in the hospital pharmacies in the district of Hebron. Descriptive approach is considered the best in studies that aim to determine the reality of a particular phenomenon (Jong & vd Voordt, 2002). Since the present study is concerned with describing the phenomenon on qualitative and quantitative aspects whereby the qualitative exposition is concerned with describing features and characteristics of the phenomenon, the quantitative description gives a numerical expression that shows the amount and direction of the phenomenon and the degree of its connection with other phenomena (Sa'ati, 1991).

3.3 Population of the Study

The target population include pharmacists and IT staff working for hospital pharmacies in the district of Hebron. According to the Palestinian Ministry of Health; there are 9 hospitals in the district of Hebron classified as either public or private hospitals that vary in specialties and sizes (see table.2 below).

Table (2) lists the hospitals in the district of Hebron, their location, EMR system used, and the type of hospital based on their administrative authority.

***Table 2**: List of Hebron district Hospitals and EMR systems used*

Hospital	Location	EMR sys.	Type
Princess Alia Gov. Hospital	Hebron	Avicenna	Governmental (Public)
Mohammad Ali Al-Mohtasib Gov. hospital	Hebron	Avicenna	Governmental (Public)
Martyr Abu Al-Hassan Al-Qasem Gov. Hospital	Yatta	Avicenna	Governmental (Public)
Dura Gov. hospital	Dura	Avicenna	Governmental (Public)
Al-Ahly Hospital	Hebron	Care	Nongovernmental
Palestine Red Crescent Society Hospital	Hebron	Al Sahl	Nongovernmental
Al-Meezan Hospital	Hebron	HMS	Private
St John	Hebron	APEX	Private
Royal Hospital - Maternity	Hebron	ALHAKEEM	Private
Total		**9 Hospitals**	

3.4 Sample Size and Selection Procedure

As a population of the study is small enough to include, the researcher used the comprehensive survey method to include all the members in the study community; hospitals pharmacists and IT staff). It targeted all members of the statistical community without any exceptions. (Aldamen, 2007).

Table (3) below lists the numbers of the sample size for (hospitals' pharmacists and IT staff).

***Table 3**: Sample Number for Hospitals' Pharmacists and IT Staff*

Hospital Name	Pharmacists	IT Staff
Princess Alia Gov. hospital	9	2
Mohammad Ali Almohtasib Gov. hospital	3	1
Marty Abu Al-Hassan Al-Qasem	4	2
Dura Gov. hospital	3	1
Al-Ahly	7	2
Palestine Red Crescent Society	4	2
Al-Meezan	3	2
St John	2	1
Royal Hospital – Maternity	3	1
Total	**38**	**14**

3.5 Research Data Collection Instruments

This study has two parts. The first is theoretical while the other is practical. In the theoretical part, the researcher depends on the previous related academic studies to establish a solid background knowledge to facilitate developing data collection instruments. In the practical part, however, the researcher relies on descriptive and analytical methods using some programs to collect, and analyze data, answer questions, test hypotheses and final put down conclusions and results. Here, the data was collected using two main sources:

3.5.1 Secondary Sources:

Secondary sources refer to theoretical sources that provide data by reviewing previous literature and the academic research related to the subject of the present study. In

addition, these sources also utilized academic and scientific books that dealt with the topic of “PIS” in general, doctoral and master’s dissertations and theses, scientific articles, websites, research and refereed scientific journals published on the Internet, and summaries of researches published in relevant conference releases.

3.5.2 Primary Sources:

These are sources which the researcher relied on the field or practical data collected from the participants of the study community using the main study instrument, the questionnaire. In addition to the main PIS evaluation model with the 7-levels, shown in Table (4).

Questionnaire of the Study:

This questionnaire, the researcher's tool for data collection, is composed of many sections and series of questions that prompt despondence to answer it (Patra, 2019). For the sake of the present study, the questionnaire is used as the main instrument for collecting data, with three main parts:

Section 1: The introduction and welcoming paragraph that contains general overview about the main objective of the study, researcher, supervisor, master program and the ethical commitments statement.

Section two:

It introduces the demographic data including respondents' position, gender, age, experience, and qualification. It also states basics about the hospital characteristics; type, size, IT department, type of information, controlled data base.

Section Three: Automation Levels of PIS

In this part, the researcher raises questions about the levels of automation of PIS, challenges and obstacles facing the development of E-PIS use in Palestine.

Some questions in sections (2) and (3) are designed to list close-ended questions with different types restricting respondents' answers in two options; (Yes or No). Differently,

multiple-choice questions allow respondents to select one from several options. While section (4) used a scaled questions that allow respondents to select one from a range of options. In scaled questions, respondents were required to select the answer based on a (5-point Likert scale) with range values from (1-5).

Table (4) below introduces questions that are related to PIS levels. As mentioned before, this thesis will assess first four levels only (levels 1-4) of hospitals in the district of Hebron.

***Table 4**: PIS 7 Levels*

Level name	Description	Questions
Electronic Medicine Management (EMM)	Focuses on management of the pharmacy department (Medicine labeling, pricing, ordering management, stock control, ordering tracking, Medicine description and invoice)	▪ Is your PIS tied to the pharmacy stock? ▪ Are daily reports submitted on the amount of medication dispensed? ▪ Are periodic reports submitted to control the amount of medication dispensed? ▪ Are reports submitted regarding the medication to be purchased? ▪ Are drug price reports submitted? ▪ Are reports related to the annual performance of the pharmacy submitted? ▪ Are reports submitted regarding

Level name	Description	Questions
		the pharmacy's financial position? ▪ Are medications categorized, pricing, and ordered to administer? ▪ Is medication stock monitored (drugs available, number of packages available, expiration dates, etc.)? ▪ Is a tracer ward stock inventory ordered (in the hospital pharmacy)? ▪ Is medication prescribed and billed when dispensing patients?
Electronic Prescribing Service (EPS)	Focuses on electronic generation, transmission and filling of a medical prescription (electronically fill prescription and transmit the prescription to PIS)	▪ Are prescriptions requests received in the pharmacy electronically through? ▪ Are prescription requests received at the pharmacy with a handwritten copy? ▪ Does your PIS send a confirmation letter to your doctor and other menstrual systems? ▪ Is drug data stored in the local pharmacy database? ▪ Does your PIS allow pharmacist to fill prescriptions that are received from preorders as paper-based

Level name	Description	Questions
		prescription? ▪ Does your PIS receive electronic prescribe from providers (pharmacist, nurse) electronically? ▪ Does your PIS store prescription data in to patient medical record? ▪ Does your PIS use and store the scientific name of medication (i.e., use standard code for drugs)?
Electronic Drug-Drug Interactions (EDDIs)	Focuses on helping clinicians OR pharmacists to identify and prevent clinically significant drug interactions or unexpected side effects.	▪ Does your PIS have access to drug formularies? ▪ Does your PIS have inappropriate dosage alerts? ▪ Does your PIS have drug–drug interaction/contraindication alerts? ▪ Does your PIS check for maximum dosage?
Electronic Drug-Disease Interaction	Focuses on helping clinicians OR pharmacists to identify and prevent clinically-significant drug- Disease interactions	▪ Does your PIS have access to patient medical histories? ▪ Does your PIS have drug-allergy alerts? ▪ Does your PIS recommend therapeutic drug monitoring or lab tests?

Level name	Description	Questions
		▪ Does your PIS support drug-to-indications linkage? ▪ Does your hospital have a computerized adverse drug event (ADE) monitor using the electronic medical records? ▪ Does your PIS have drug–disease/condition alerts?

3.6 Validity and Reliability of the Study Tools

3.6.1 Face Validity:

To test the questionnaire for clarity and to provide a coherent research questionnaire, a macro review that covers all the research constructs was thoroughly performed by academic reviewers from local universities. Some items were added, while others were dropped based on their valuable recommendations. Some others were reformulated to become more accurate to enhance the research instrument.

3.6.2 Internal Consistency:

Pearson correlation test was used to test the validity of the questionnaire, by testing the correlation between paragraphs and an internal correlation between various dimensions of questionnaire. Table (5) shows Pearson correlation test for the questionnaire items.

Table 5: *Pearson Correlation Test*

Items	Level1	Level2	Level3	Level4	Obstacles
1	.356**	.788**	.481**	.433**	.813**
2	.462**	.337*	.593**	.566**	.751**
3	.236	.133	.517**	.387**	.806**

Items	Level1	Level2	Level3	Level4	Obstacles
4	.660**	.[a]	.609**	.291*	.813**
5	.504**	.420**		.348*	.618**
6	.364**	.644**		.696**	.241
7	.646**	.663**			.587**
8	.534**	.775**			
9	.626**				
10	.453**				
11	.480**				
Levels correlation	**.814****	**.793****	**.431****	**.713****	**-**
Tool correlation	**.355****	**.705****	**.390****	**.409****	**.700****

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

** Correlation is significant at the 0.01 level (2-tailed).

As shown in table (5), the majority of items are significantly correlated with its variables and all of variables are correlated with each other. Therefore, the used instrument is valid to measure the level of PIS in hospital pharmacy and the potential obstacles to hinder its development.

3.7 Reliability

Cronbach's alpha was used to determine the internal consistency reliability of the elements as suggested by Downing (2004). Reliability should be (0.60) or higher to

indicate adequate convergence or internal consistency. The results shown in **Table (6)** are acceptable as suggested by (Sekaran & Bougie, 2019).

According to the overall degree of Cronbach's alpha value, the results of the questionnaire will stay the same as nearly as (70.8%) if the tool is re-applied to the study sample under the same conditions.

Table 6: *Cronbach's Alpha Test*

Dimension	Responses	Items	Cronbach's alpha value
PIS Levels	52	29	.760
Obstacles	52	7	.609
Over-all Degree	**52**	**36**	**.708**

3.8 Methods of Data Analysis (Statistical Analysis)

The data collected from the responses to the questionnaire were examined using the Statistical Package for Social Sciences "SPSS Ver.22" and the Microsoft Excel 2016 for analysis and conclusions. Then, the researcher applied two suitable statistical methods, namely the descriptive and inferential statistics.

3.8.1 Descriptive Statistics:

It is a form of data analysis that is basically used to describe, show or summarize data from a sample in a meaningful way. In other words, descriptive statistics attempts to illustrate the relationship between variables in a sample or population and give a summary in the form of percentage and frequency. In addition, it is arithmetic to identify the level of response of study sample individuals to the study variables, Furthermore, standard deviation is used to measure the responses spacing degree about arithmetic mean (Sweidan, 2016).

3.8.2 Inferential Statistics:

This method is used to excerpt conclusions from the data sample. Also, probability distribution, correlation testing and regression analysis fall into this category. In simple words, inferential statistics employ a random sample of data taken from a population, to make and explain inferences about the whole population. Therefore, this study used Pearson correlation analysis for validity, Cronbach Alpha reliability (α) to measure strength of the correlation and coherence between questionnaire items (one sample t-test), and (ANOVA) for testing demographic variables.

The researcher determines the weighted average of each point according to the 5-point Likert scale. The range is calculated by subtracting the value of the first scale from the last scale ($5 - 1 = 4$). Then, the result is divided by five as it is the highest value of the scale ($4 \div 5 = 0.8$). Afterward, the minimum value of the scale which is (1) was added to identify the weighted average of the first scale.

4. CHAPTER IV. RESULTS & DISCUSSION

4.1 Introduction

This chapter, in light of the purpose of the research, the research framework, and the study literature review and methodology previewed in previous chapters, will describe the results of the collected data statistical analysis, answer research questions, and test research hypotheses.

This chapter includes a calculation of a quantitative correction key to be used as a reference point to judge questionnaire tools as a whole, dimensions, and sentences. In addition to the key, the chapter includes demographic analysis, hospital characteristic analysis, and a description of dimensions of the results in terms of the arithmetic mean and standard deviation, t-test and ANOVA for testing demographic variables.

4.2 Quantitative Correction Key

As the researcher used two types of Likert scale (three and five) points, a quantitative correction key was made for each.

4.2.1 3-point Likert scale

The researcher determines the weighted average of each point of the 3-point Likert scale. The range was calculated by subtracting the value of the first scale from the last scale (3−1 = 2). Then, the result is divided by the number of intervals needed which is (3), (2÷3 = 0.667) resulting number represents the interval size. Afterward, the first interval starts from the minimum value of the scale, which is (1), and ends with (1.66), then the second and third intervals formed as shown in **Table (7)**.

***Table 7**: Correction Key for a 3-Point Likert Scale*

Range			Degree
1.00	–	1.66	Low (L)
1.67	–	2.33	Medium (M)
2.34	–	3.00	High (H)

4.2.2 5-point Likert scale

For the 5-point Likert scale, the researcher followed up the same steps to create the quantitative key of three intervals, using the range value (5-1=4) and class interval (4÷3=1.33). Therefore, the first interval size from (1) to (2.66), then the second and third intervals formed as shown in **Table (8)**.

Table 8: *Correction Key for a 5-Point Likert Scale*

Range			Degree
1.00	–	2.33	Low (L)
2.34	–	3.66	Medium (M)
3.67	–	5.00	High (H)

4.3 Demographic Analysis

The demographic analysis presents the characteristics of the valid respondents, for example, frequency and percentage of participants for the demographic variables (position, gender, age, experience, and education).

4.3.1 Position:

Table (9) shows that out of a total of 52 employees, the majority of respondents are pharmacists equal to 30 representing (57.7%), in addition to 14 staff in the IT department with (26.9%). Moreover, 8 pharmacists worked in medical store representing (15.4%).

Table 9*: Position Analysis*

Position	Frequency	Percentage
Pharmacists	30	57.7%
Medical Store Staff	8	15.4%
IT Staff	14	26.9%

Position	Frequency	Percentage
Total	**52**	**100.0%**

4.3.2 Gender:

Table (10) shows that the majority of respondents are 30 females, representing (57.7%), and only 22 males with (42.3%). This is justified since the female proportion is higher within the scope of the pharmaceutical industry in accordance with the percentage of university graduates.

Table 10: *Gender Analysis*

Gender	Frequency	Percentage
Male	22	42.3%
Female	30	57.7%
Total	**52**	**100.0%**

4.3.3 Age:

Table (11) shows that the majority of respondents (44 persons) are aged below (45) representing (84.6%) out of the total sample, whereas (7) fell into the age group of (45-55 years) with (13.5%), but only one employee was 55 years old sharing (1.9%). This is relatively associated with the retirement law that allows the employee to get retirement earlier to the by-law- retirement at sixty. It also refers the high dominance of females in the industry, as they may prefer to quit job at an earlier age compared to men's due to long working hours, night shifts and family responsibilities.

Table 11: *Age Analysis*

Age	Frequency	Percentage
Less Than 35 Years	22	42.3%
From 35 – 45 Years	22	42.3%

Age	Frequency	Percentage
From 45 – 55 Years	7	13.5%
Older than 55 Years	1	1.9%
Total	**52**	**100.0%**

4.3.4 Experience:

Table (12) shows that the majority of respondents have experience of more than (10 years), 32 employees equals to (61.5%), whereas 16 respondents representing (30.8%) experience between (5-10) years. Finally, only (9) spent less than (5) years showing (6%). These percentages are directly related to employee desire for job stability since employees usually tend to maintain their positions looking forward to improving their abilities over the time.

***Table 12**: Experience Analysis*

Experience	Frequency	Percentage
Less Than 5 Years	4	7.7%
From 5 – 10 Years	16	30.8%
More Than 10 Years	32	61.5%
Total	**52**	**100.0%**

4.3.5 Education

Table (13) shows that the majority of respondents hold BA degrees related to the fields of healthcare professions. This actually emphasizes a continuity of learning and improvements. In fact, it indicates the presence of (39) BA employees representing (75.0%) of the respondents whereas (11) respondents equal to (21.2%) have done MA qualifications in pharmacy and that only (2) has diplomas in pharmacy representing (3.8%) of the population.

***Table 13**: Education Analysis*

Education	Frequency	Percentage
Diploma	2	3.8%
Bachelor	39	75.0%
Higher studies	11	21.2%
Total	**52**	**100.0%**

4.4 Study Results

To answer the present study questions and test its hypotheses, the "SPSS 22" software was used to conduct a descriptive analysis by using statistical methods. The mean, standard deviation, and ranking were used to describe the respondents' perception. Then the overall degree of each level, dimension, and item are defined based on quantitative correction key which was developed in advance.

4.4.1 Result (1): Hospital Pharmacies and PIS

Result (1) answers the first question of this study "**To what extent do hospital pharmacies in Hebron district use automated Pharmacy Information System (PIS)?**"

Table (14) shows that the means of PIS level range between (2.66 - 1.31), and the standard deviations range between (0.672-0.624). This indicates that there is a significant difference in the responses of the study sample to the degree of application of PIS.

The average mean is 2.23 with a standard deviation of 0.905, which indicates that the respondents agree that levels 1 and 2 are highly attained. While the third and fourth levels are not totally applied within the hospital systems.

Table 14: *Mean, Standard Deviation, and over-all Degree of sample response on the PIS levels at Hebron Hospitals*

#	Rank	Level	Mean	Standard Deviation	Over-all Degree
1	1	Level 1	2.66	0.672	H
2	2	Level 2	2.52	0.806	H
4	3	Level 4	1.68	0.826	M
3	4	Level 3	1.31	0.624	L
		Total	**2.23**	**0.905**	M

4.4.1.1 Level (1)

Table (15) shows that majority of the paragraphs expressing "Level 1" have obtained high means ranging between (2.88 to 2.25), with a standard deviations ranging between (0.471 and 0.738). This indicates that respondents agree on the high implementation of level 1.

Question 6 "**Are reports related to the annual performance of the pharmacy submitted?**" with the highest mean 2.88 and standard deviation of 0.471 which indicate that there was a strong reporting system in hospitals pharmacy in the district of Hebron.
.

Question 7 "**Are reports submitted regarding the pharmacy's financial position?**" with the lowest mean average of 2.25 and standard deviations of 0.738, this can be explained in the light of the fact that the financial position of the pharmacy is not among the authority available for review by pharmacists.

Table 15: *Mean, Standard Deviation, and Over-all Degree of Sample Response on the PIS Level (1) at Hebron Hospitals*

#	Rank	Paragraph	Mean	Standard Deviation	Over-all Degree
6	1	Are reports related to the annual performance of the pharmacy submitted?	2.88	0.471	H
1	2	Is your PIS tied to pharmacy stock?	2.87	0.486	H
2	3	Are daily reports submitted on the amount of medication dispensed?	2.87	0.486	H
3	4	Are periodic reports submitted to control the amount of medication dispensed?	2.87	0.345	H
10	5	Is a tracer ward stock inventory ordered (in the hospital pharmacy)?	2.85	0.538	H
11	6	Is medication prescribed and billed when dispensing patients?	2.85	0.460	H
5	7	Are drug price reports submitted?	2.77	0.509	H
8	8	Are medications categorized, pricing, and ordered to administer?	2.52	0.727	H
4	9	Are reports submitted regarding the medication to be purchased?	2.31	0.940	M
9	10	Is medication stock monitored (drugs available, number of packages available, expiration dates, etc.)?	2.29	0.893	M
7	11	Are reports submitted regarding the pharmacy's financial position?	2.25	0.738	M
		Level 1	**2.66**	**0.672**	**H**

4.4.1.2 Level 2

Table (16) shows that majority of paragraphs expressing "Level 2" have obtained high means ranging between 3.00 to 1.88, with a standard deviations between 0.806 and 0.878. This indicates that respondents agree at a high implementation of level 2.

Paragraph 4 **"Is drug data stored in the local pharmacy database?"** with the highest mean 3.00 and standard deviations of 0.806, which indicate that there was a centralized database for drugs available in the hospitals of Hebron district.

Paragraph 5 **"Does your PIS allow pharmacist to fill prescriptions that are received from preorders as paper-based prescription?"** This paragraph shows the lowest mean at 1.88 with standard deviations of 0.878. This actually indicates that the PIS systems are closed systems with specific permissions for each user.

Table 16: *Mean, Standard Deviation, and over-all Degree of sample response on the PIS level (2) at Hebron Hospitals*

#	Rank	Paragraph	Mean	Standard Deviation	Over-all Degree
4	1	Is drug data stored in the local pharmacy database?	3.00	0.806	H
7	2	Does your PIS store prescription data in to patient medical record?	2.85	0.538	H
8	3	Does your PIS use and store the scientific name of medication (i.e. use standard code for drugs)?	2.77	0.645	H
2	4	Are prescription requests received at the pharmacy with a handwritten copy?	2.62	0.745	H
1	5	Are prescriptions requests received in the pharmacy electronically?	2.58	0.825	H
3	6	Does your PIS send a confirmation letter to your doctor and other systems?	2.46	0.803	H
6	7	Does your PIS receive Electronic Prescribing from providers (pharmacist, nurse) electronically?	2.00	0.907	M

#	Rank	Paragraph	Mean	Standard Deviation	Over-all Degree
5	8	Does your PIS allow pharmacist to fill prescriptions that are received from preorders as paper-based prescription?	1.88	0.878	M
		Level 2	**2.52**	**0.806**	**H**

4.4.1.3 Level 3

Table (17) shows that all paragraphs expressing the "Level 3" have obtained low means ranging between 1.54 to 1.12, with standard deviations between 0.803 and 0.323. This indicates that respondents agree on the low implementation of level 3.

Paragraph 2 "**Does your PIS have inappropriate dosage alerts?**" This shows the highest mean of 1.54 and standard deviations of 0.803.

Paragraph 3 "**Does your PIS have drug–drug interaction/contraindication alerts?**" it obtains the lowest mean 1.12 and standard deviations of 0.323, indicating that the PIS in Hebron district Hospitals has not self-alerts program service to prevent mistakes.

Table 17: *Mean, Standard Deviation, and over-all Degree of sample response on the PIS level (3) at Hebron Hospitals*

#	Rank	Paragraph	Mean	Standard Deviation	Over-all Degree
2	1	Does your PIS have inappropriate dosage alerts?	1.54	0.803	L
1	2	Does your PIS have access to drug formularies?	1.46	0.727	L
4	3	Does your PIS check for maximum dosage?	1.13	0.397	L
3	4	Does your PIS have drug–drug interaction/contraindication alerts?	1.12	0.323	L
		Level 3	**1.31**	**0.624**	**L**

4.4.1.4 Level 4

Table (18) shows that paragraphs expressing "Level 4" have obtained medium means ranging between 2.54 to 1.13, with a standard deviations between 0.828 and 0.397.

Paragraph 2 "**Does your PIS have drug-allergy alerts?**" obtains the highest mean 2.54 and standard deviations of 0.828,

paragraph 3 "**Does your PIS recommend therapeutic drug monitoring or lab tests?**" has the lowest mean 1.13 and standard deviations of 0.397.

Table 18: *Mean, Standard Deviation, and over-all Degree of sample response on the PIS level (4) at Hebron Hospitals*

#	Rank	Paragraph	Mean	Standard Deviation	Over-all Degree
2	1	Does your PIS have drug-allergy alerts?	2.54	0.828	H
1	2	Does your PIS have access to patient medical histories?	2.33	0.706	M
5	3	Does your hospital have a computerized adverse drug event (ADE) monitor using the electronic medical records?	1.50	0.505	L
6	4	Does your PIS have drug–disease/condition alerts?	1.37	0.715	L
4	5	Does your PIS support drug-to-indications linkage?	1.19	0.445	L
3	6	Does your PIS recommend therapeutic drug monitoring or lab tests?	1.13	0.397	L
		Level 4	**1.68**	**0.826**	**M**

4.4.2 Result (2): Challenges and Obstacles

Result (2) answers the second question of the present study "**What challenges and obstacles do face the development of the use of electronic PIS in Palestine?**"

Table (19) shows that all paragraphs expressing the obstacles of developing PIS have obtained medium means ranging between 3.42 to 2.88, with standard deviations between 1.319 and 1.409. This indicates that respondents agree on the medium degree of obstacles faced the development of PIS.

Paragraph 4 "**Weak financial funds required providing and updating these systems**" it indicates the highest mean 3.42 and standard deviations of 1.319,

Paragraph 6 "**Lack of skills to operate and maintain computerized health information systems"**. It indicates the lowest mean 2.88 and standard deviations of 1.409.

Table 19: *Mean, Standard Deviation, and over-all Degree of sample response on the Obstacles for developing PIS at Hebron Hospitals*

#	Rank	Paragraph	Mean	Standard Deviation	Over-all Degree
4	1	Weak financial funds required to provide and update these systems	3.42	1.319	M
1	2	The small number of computers available in the different departments in terms of the number of transactions that these machines need to complete.	3.27	1.223	M
3	3	Lack of vision towards the need for comprehensive and long-term planning for E-Health applications and consideration of responding to computing needs of a typically temporary or short-term nature	3.23	1.262	M
5	4	Frequent hardware and network failures and insufficient maintenance	3.21	1.473	M
2	5	Lack of awareness and limited experience of the role of computerized health information systems in health care	3.04	1.220	M
7	6	Lack of effective control and prevention of the health information system.	2.90	1.053	M
6	7	Lack of skills to operate and maintain computerized health information systems	2.88	1.409	M
		Obstacles	**3.14**	**1.289**	**M**

4.4.3 Result (3): usage of PIS based on demographical variables

Result (3) answers the third question of this study: "are there statistical significant differences at the level ($0.05 \geq \alpha$) between the averages of the study sample's estimates of the degree of using PIS in the hospitals of Hebron district due to variables of hospital type, position, gender, age, work experience, and academic qualification)?"

To answer question 3, (independent sample t-test, and One-way ANOVA test) are used to verify the significance of mean differences of the degree of using PIS's according to the variables (hospital type, position, gender, age, work experience, and academic qualification), as shown in Tables (20) and (21). (see the appendices)

Table 20: *Independent sample t-test to identify the significance of mean differences in the degree of using PIS according to the hospital type variable and Gender variable*

Variable	Level	Hospital Type	Number	Mean	Standard Deviation	t-value	Sig.
Hospital type	Level1	Public	26	2.60	0.315	-1.393	0.170
		Private	26	2.72	0.300		
	Level2	Public	26	2.56	0.375	0.785	0.436
		Private	26	2.48	0.331		
	Level3	Public	26	1.45	0.224	3.624	0.001
		Private	26	1.17	0.322		
	Level4	Public	26	1.66	0.304	-0.397	0.693
		Private	26	1.69	0.278		
	Total	**Public**	**26**	**2.24**	**0.263**	**0.122**	**0.904**
		Private	**26**	**2.23**	**0.205**		
Gender	Level1	Male	22	2.72	0.337	1.174	0.246
		Female	30	2.62	0.288		

Variable	Level	Hospital Type	Number	Mean	Standard Deviation	t-value	Sig.
	Level2	Male	22	2.45	0.308	-1.138	0.261
		Female	30	2.57	0.380		
	Level3	Male	22	1.30	0.383	-0.317	0.753
		Female	30	1.33	0.247		
	Level4	Male	22	1.73	0.328	1.093	0.279
		Female	30	1.64	0.256		
	Total	**Male**	**22**	**2.25**	**0.227**	**0.332**	**0.742**
		Female	**30**	**2.22**	**0.242**		

Based on the results presented in Table (20), it appears that there is no significant mean difference in the degree of using PIS according to the hospital type variable in levels (1, 2, 4 and the total of all levels). While the differences are indicated in level (3). In addition, there is no significant mean difference in the degree of using PIS with due regard to gender.

***Table 21**: One-Way ANOVA test to identify the significance of mean differences in the degree of using PIS according to the variables (Position, Age, Work Experience, and Academic Qualification)*

Level		Sum of Squares	d.f.	Mean Square	F	Sig.
Position	Between Groups	0.328	2	0.164	3.271	**0.046**
	Within Groups	2.458	49	0.05		
	Total	2.786	51			
Age	Between Groups	0.583	3	0.194	4.232	**0.010**
	Within Groups	2.203	48	0.046		
	Total	2.786	51			
Work Experience	Between Groups	0.126	2	0.063	1.164	**0.321**
	Within Groups	2.660	49	0.054		
	Total	2.786	51			

Level		Sum of Squares	d.f.	Mean Square	F	Sig.
Academic Qualification	Between Groups	0.249	2	0.124	2.401	**0.101**
	Within Groups	2.538	49	0.052		
	Total	2.786	51			

Based on the results presented in Table (21), it appears that there is a significant mean difference in the degree of using PIS according to variables of (position and age). On the other hand, there are no significance mean differences in the degree of using PIS according to (]work experience and academic qualification.

4.4.4 Result (4): Challenges of PIS Usage Based on demographical variables

Result (4) answers the fourth question of the present study: "are there statistically significant differences at the level ($0.05 \geq \alpha$) between the averages of the study sample's estimates of the obstacles to the development of PIS's in the hospitals of Hebron districts due to these variables; hospital type, position, gender, age, work experience, and academic qualification)?"

To answer this question, (independent sample t-test, and One-way ANOVA test) were used to verify the significance of mean differences of the obstacles to the development of PIS's according to the variables (hospital type, position, gender, age, work experience, and academic qualification), as shown in Tables (22) and (23) shown in the appendix

Table 22: *Independent sample t-test to identify the significance of mean differences in the obstacles to the development of PIS's according to the hospital type variable and Gender variable*

Variable		Number	Mean	Standard Deviation	t-value	Sig.
Hospital Type	Public	26	3.76	0.343	8.130	**0.000**
	Private	26	2.51	0.707		

Variable		Number	Mean	Standard Deviation	t-value	Sig.
Gender	Male	22	2.71	0.834	-3.402	**0.002**
	Female	30	3.45	0.700		

Based on the results presented in Table (22), it appears that there is significant mean difference in the obstacles to the development of PIS's according to the hospital type variable and gender variable.

Table 23: *One-Way ANOVA test to identify the significance of mean differences in the obstacles to the development of PIS's according to the variables (Position, Age, Work Experience, and Academic Qualification)*

Variables		Sum of Squares	d.f.	Mean Square	F	Sig.
Position	Between Groups	0.048	2	0.024	0.033	**0.967**
	Within Groups	35.787	49	0.730		
	Total	35.835	51			
Age	Between Groups	4.967	3	1.656	2.575	**0.065**
	Within Groups	30.868	48	0.643		
	Total	35.835	51			
Work Experience	Between Groups	0.397	2	0.199	0.274	**0.761**
	Within Groups	35.438	49	0.723		
	Total	35.835	51			
Academic Qualification	Between Groups	1.147	2	0.573	0.810	**0.451**
	Within Groups	34.688	49	0.708		
	Total	35.835	51			

Based on the results presented in Table (23), it appears that there is no significant mean difference in the obstacles to the development of PIS's according to the variables position, age, work experience, and academic qualification)

4.5 Discussion of Results

The study results indicates the importance of using PIS in hospitals, and the necessity of integrating this system with other hospital systems to achieve the greatest possible effective benefit. These results are compatible with studies (Al-Asafra & Amro, 2022; Mahoney et. al., 2007) that confirmed the importance of adoption of HIS different systems which included PIS. However, this result contradicts with the study of (Murray et. al., 1998) that showed no significant differences in based of time consumption between traditional paper work and electronic work.

4.5.1 Result (1): Hospital Pharmacies and PIS

To what extent do hospital pharmacies in Hebron district use automated (PIS)?

Results of the study showed high degree of using level (1) and (2), but a low degree of level (3), and medium degree for level (4). Overall results showed that PIS utilization is in medium degree, this result is actually compatible with (Kagoya, ET. Al., 2020) results indicating limited/medium utility of HIS systems. High degree results of Level (1) and (2) are compatible with the results of (El Mahalli, El-Khafif, & Yamani, 2016; Isfahani, Mirzaeian & Habibi, 2013) which indicate a high degree PIS utilization in term of reporting (level1) and automating of paper-work which represents (level2). However, this result contradicts the results of (Kagoya, et. al., 2020; Allaf, 2009) which indicated a low degree of PIS use at these levels.

The researcher explains the high degree of application of the first and second levels of PIS in the light of available systems and its capabilities to receiving data and releasing periodic and non-periodic reports. In addition to the efforts of hospital administration to introduce new technologies and take the positive impact in facilitating work and saving time, effort and costs. Therefore, the requirements for applying the first and second levels are available within the current working HIS systems in Hebron district hospitals.

The high degree of level (1) from the researcher viewpoint can be attributed to the nature of the software used in Hebron district hospitals. PIS included a strong reporting system that depends on a strong database system links process, people, and hospital departments with each other. So any activity could be registered and accessed by anyone authorized to access.

Moreover, the current software allows users to switch from the paper-based system to the electronic-work system, medical reports and prescriptions in consequence become accessible utilizing electronic version of data. Provided that, the researcher suggests that the high degree of application of the second level of PISs is logical in light of the available capabilities in hospitals and the requirements' of level (2).

The results of level (3) show low degree of use, the matter that shows compatible with the results of (Kagoya, ET. Al., 2020; Farzandipour et. al, 2017); also indicating low levels of alerting systems that may prevent human mistakes like drug-drug interaction.

On the other hand, the process of verifying the non-compliance of drugs and their internal components and warnings of inappropriate use of drugs is done personally without supervision from the electronic system, except of warnings related to allergy drugs. a specific substance or drug. The researcher explains this result by the availability of patient records in the current electronic system, which facilitates the process of electronic warning of patients' allergy to a particular substance or drug.

4.5.2 Result (2): Challenges and Obstacles

What are the challenges and obstacles facing the development of the use of electronic PIS in Palestine?

The total degree of obstacles that encounter the application of PISs seems on average for all elements, and the researcher explains this result in the light of the development of electronic hospital systems and the effort made by the hospital administration to develop the systems constantly through providing the needed materials, developing human resources and providing them with the necessary training.

Financial constraints are count as major challenge that faces utilizing PIS in Hebron district hospitals. This result is in compatible with (Al-Asafra & Amro, 2022; Carroll & Richardson, 2020) results that mentioned the financial issues as one of the most challenging barriers against the possibility of utilizing HIS. In addition, this result seems computable with the result of (Allaf, 2009) who indicates the significance of the infrastructure and an internal network as major problems in the adoption and implementation of HISs.

The researcher also explains that financial constraints have the highest degree of effect among other constraints as private and public hospitals suffer from financial troubles and severe shortage of fund; due to the constant increase in running costs, global financial crises, and the Palestinian authority's ministry of finance delays to pay the costs of patients' cross- public-private hospital medical referrals.

4.5.3 Result (3): Usage of PIS based on Human Factors

Are there statistically significant differences at the level ($0.05 \geq \alpha$) between the averages of the study sample's estimates of the degree of using PIS's in the hospitals of Hebron district due to these variables; (Hospital Type, Position, Gender, Age, Work Experience, and Academic Qualification)?

The results showed that there is a significant difference between the responses of the study sample individuals due the variables of position and age.

The researcher explains the difference in responses to the variable of job position in the difference of understanding of current systems among the respondents, where the IT employees have better knowledge and experiences regarding the capabilities of the system than that of pharmacists, and medical store staff. Therefore, pharmacists and medical store staff usually do not fully benefit from the system except within the narrowest limits that helps them to do their daily works.

Also, the researcher refers age variables between the study answers to the difference in the degree of adoption of new technologies according to the age group. In that, it is thought that older employees commonly tend to adhere to the traditional ways of work, while new generations are more eligible to opt for e-system.

Similarly, the results showed difference between the responses of government and private hospital employees about the degree of achieving the third level of PIS. The researcher attributes this result to the fact that public hospitals depend on global health management systems designed and managed by companies that have experience and a

wide spread in various countries over the world. While private hospitals adopt health management systems that are less leveled than those applied in government hospitals.

4.5.4 Result (4): Challenges of PIS Usage Based on Human Factors

Are there statistically significant differences at the level ($0.05 \geq \alpha$) between the averages of the study sample's estimations of the degree of using PISs in the hospitals of Hebron district due to variables of (Hospital Type, Position, Gender, Age, Work Experience, and Academic Qualification)?

The results showed that there is a significant difference between the responses of the study sample respondents to the variables of (Hospital type, and Gender) about the obstacles for adoption of PIS's.

The researcher explains the reason for the different responses of the study sample to the obstacles facing the application of PIS variable of the hospital type due to the financial and human capabilities of each type; in that private hospitals can provide their needs and face obstacles, usually easier and faster than that of public hospitals. In addition, public hospitals suffer from great overload due to the increasing number of clients and inpatients. This situation increases the possibility of countering urgent problems arise to gain priority to solve than PIS development.

As for gender variables, the researcher attributes the difference in the answers regarding the obstacles to applying PIS due to gender to the nature of how either males or females independently look at problems and the way of solving them. As females are interested in the interface of the system and the ease of interaction with it, males focus on the performance of the system in general without regardless the PIS external aspects or design. Additionally, both females and males differ in the method of evaluating services, as females often focus on the shortcomings and imbalances in the system more than focusing on its positive aspects.

5. CHAPTER V.: CONCLUSION AND FUTURE WORKS

5.1 Introduction:

In accordance with chapter IV' which introduces statistical analysis of the data and discusses results of the study, Chapter V., states summaries of findings, recommendations, and potential proposed future work.

5.2 Recommendation of the Study:

As mentioned in Chapter V, results show that the first and second levels of PIS attained high in degree. This result is positive and might enhance the patient safety and reduce medical error. For example, using e-prescription reduced the error of reading drug name and medication dose. Here, the researcher recommendation is to raise the awareness of the benefits and importance of the two levels in among hospital pharmacist. Community pharmacists are likely encouraged to apply PIS that support at least levels (1) and (2). The intended awareness could be achieved through workshops, professional PIS training and promotions on social media platforms.

However, regarding level (3),this mainly related to lack use of coding standards, and scientific names of drugs used within a narrow frame only. This referred to the fact that PIS can have an access to patient information stored in the hospital central database, still it cannot have an access into information in other health institutions.

Accordingly, the researcher states below the study recommendations, regarding the Palestinian government, The Ministry of Health, in particular.

- Investing in the development of PISs and activate them properly in hospitals.
- Enacting laws that encourage/enforce all health institutions to share patient data with other institutions, while emphasizing the principle of maintaining the privacy and confidentiality of patients' data, to be strictly used only in the medical context.

- Enacting and passing laws that encourage physicians and pharmacists to use the scientific names of drugs instead of brand names drug manufacturing companies.

- Raising the awareness of the importance of using the scientific names of drugs and the significance of testing the drug-drug interaction.
- Encourage pharmacists to use PISs that support drug-drug interaction services.
- Encouraging the IT companies to consider drug-drug interactions when they develop PIS.

The degree of using the fourth level of PIS was medium. So, the researcher recommendations are compatible with (Al-Asafra & Amro, 2022) recommendation to the Ministry of Health for establishing a central database to store patients' data from all health institutions, facilitating the exchange of information between different them and encouraging healthcare institutions to share patients data as well as raising the awareness of the importance of sharing patients data.

The financial constraints showed the highest effect among the impediments to the development of PIS followed by lack of computers available in the departments to achieve the required work. The researcher recommends health administration to allocate adequate budget to cover the requirements for the establishment and development of PISs being one of the most important components of health work

The obstacles related to the availability of human capabilities to operate and maintain the health information system were the least agreeable among the obstacles facing the PIS development. The researcher, in consequent, recommends hospitals administrations to conduct training courses for hospitals' staff regarding the best use of MIS, to seriously get the opinions of employees regarding the system and aspects of deficiencies, to develop of user's manual, and to encourage employees to use the computerized hospital systems instead of the traditional ones. The latter can be attained by developing software linked to the employees' smartphones.

There were no statistically significant differences between the averages of the study sample's estimations of the degree of using PIS's in the hospitals of Hebron district due to variables of (Hospital Type, Gender, Work Experience, and Academic Qualification).

There were statistically significant differences shown between the averages of the study sample's estimations of the degree of using PIS's in the hospitals of Hebron district due to variables of position and age.

There are no statistically significant differences between the averages of the study sample's estimations of the obstacles to the development of PISs in the hospitals of Hebron district due to variables of (Position, Age, Work Experience, and Academic Qualification).

There were statistically significant differences between the averages of the study sample's estimations of the obstacles to the development of PISs in the hospitals of Hebron district due to variables of Hospital Type, Gender.

5.3 Recommendations for Future Work:

The researcher consequently states several recommendations to be taken in consideration:

1. Develop a practical model of PIS to enable hospitals to reach the fourth level as a minimum, clarifying the requirements for reaching this level mechanisms of its implementation.

2. Study the health information systems that mutually affect and the PIS, towards the avoidance of obstacles of access to the fourth level or facilitating that.

3. Examine the effect of using health information systems in facilitating business performance, speed, and efficiency.

4. Study the impact of training and developing human capabilities in hospitals on adopting the optimal use of PIS.

BIBLIOGRAPHY

Alanazi, A., Al Rabiah, F., Gadi, H., Househ, M., & Al Dosari, B. (2018). Factors influencing pharmacists' intentions to use Pharmacy Information Systems. *Informatics in Medicine Unlocked*, *11*, 1-8.

Al-Asafra, M., & Amro, B. (2022). Towards Secure Interoperability of EHR among Healthcare Organizations in Palestine. *Hebron University Research Journal (Natural Sciences), 11*.

Aldamen, M. (2007). *Fundamentals of scientific research*, 1st edition. Dar Al-Massira House for printing and publishing, Amman, Jordan.

Allaf, M. S. (2009). Pharmacies and medication information system in Jeddah City, Saudi Arabia (Doctoral dissertation, Loughborough University).

Australian Commission on Safety and Quality in Health Care. (2012) *Electronic Medication Management Systems — A Guide to Safe Implementation*, 2nd edition, ACSQHC, Sydney.

Bougie, R., & Sekaran, U. (2019). *Research methods for business: A skill building approach*. John Wiley & Sons.

Bourgeois, D., Smith, J., Wang, S. & Mortati, J. (2022). *Components of an Information System. LibreTexts Engineering. https://eng.libretexts.org/@go/page/61821*

Carroll, N., & Richardson, I. (2020). Enablers and barriers for hospital pharmacy information systems. *Health Informatics Journal*, *26*(1), 406-419.

Chamoun, N., Usta, U., Karaoui, L. R., Salameh, P., Hallit, S., Shuhaiber, P., ... & Iskandar, K. (2020). Current trends in hospital pharmacy practice in Lebanon. *Hospital pharmacy*, *55*(2), 112-118.

Classen, D. C., Phansalkar, S., & Bates, D. W. (2011). Critical Drug-Drug Interactions for Use in Electronic Health Records Systems With Computerized Physician Order Entry. *Journal of patient safety*, *7*(2), 61-65.

Crowley, T., & Stellenberg, E. L. (2015). An evaluation of the adequacy of pharmaceutical services for the provision of antiretroviral treatment in primary health care clinics. *Health SA Gesondheid*, *20*(1), 83-90.

Downing, S. M. (2004). Reliability: on the reproducibility of assessment data. Medical education, 38(9), 1006-1012.

El Jabari, C., Macedo, M., & Al-Jabari, M. O. (2020, October). Towards a new paradigm of federated electronic health records in Palestine. In *Informatics* (Vol. 7, No. 4, p. 41). MDPI.

El Mahalli, A., El-Khafif, S. H., & Yamani, W. (2016). Assessment of Pharmacy Information System Performance in Three Hospitals in Eastern Province, Saudi Arabia. Perspectives in health information management, 13(Winter), 1b.

Farzandipour, M., Meidani, Z., Riazi, H., & Jabali, M. S. (2017). Functional Requirements of Pharmacy's Information System in Hospitals. *Frontiers in Health Informatics*, *6*(1), 1-10.

Furukawa, M., & Pollack, E. (2020). Achieving HIMSS Stage 7 designation for EMR adoption. *Nursing management*, *51*(1), 10-12.

Goundrey-Smith, S. (2013). Pharmacy Management Systems. In *Information Technology in Pharmacy* (pp. 151-173). Springer, London.

Hardy, C. (2008). "Chapter 4: Pharmacy Information Systems". *In The Pharmacy Informatics Primer*. Bethesda MD, USA: American Society of Health-System Pharmacists

Hoyt, R. E., & Yoshihashi, A. K. (2014). *Health informatics: practical guide for healthcare and information technology professionals*. Lulu. com.

Isfahani, S. S. N., Mirzaeian, R., & Habibi, M. (2013). Assessment of pharmacy information system performance in selected hospitals in isfahan city during 2011. *Jundishapur Journal of Natural Pharmaceutical Products*, *8*(1), 3.

Jabareen, H., Khader, Y., & Taweel, A. (2020). Health information systems in Jordan and Palestine: the need for health informatics training. *Eastern Mediterranean Health Journal*, *26*(11).

Jong, T. d., & vd Voordt, D. (2002). *Ways to study and research urban, architectural and technical design*. (Delft) Delft University Press Science.

Kazemi, A., Rabiei, R., Moghaddasi, H., & Deimazar, G. (2016). Pharmacy information systems in teaching hospitals: A multi-dimensional evaluation study. *Healthcare Informatics Research*, *22*(3), 231-237.

Koley, S., & Ghosh, S. (2015). A Life Saving Cloud Computing Architecture for Mobility of Sufferings. *9th INDIACom*, 5-239.

Khudhur, S. (2018). HOSPITAL PHARMACY MANAGEMENT SYSTEM. *Iraqi Journal for Computers and Informatics*, *44*(2), 27-34.

Mahalli, A. E., El-Khafif, S. H., & Yamani, W. (2016). Assessment of pharmacy information system performance in three hospitals in Eastern Province, Saudi Arabia. *Perspectives in health information management*, *13*(Winter).

Mahoney, C. D., Berard-Collins, C. M., Coleman, R., Amaral, J. F., & Cotter, C. M. (2007). Effects of an integrated clinical information system on medication safety in a multi-hospital setting. *American Journal of Health-System Pharmacy*, *64*(18), 1969-1977.

McKelvey, B., Tanriverdi, H., & Yoo, Y. (2016). Complexity and information systems research in the emerging digital world. *MIS Quarterly*, *39*(4), 995-996.

Mimi, Y. (2015). *The Routine Health Information System in Palestine: Determinants and Performance* (Doctoral dissertation, City University London).

Moullin, J. C., Sabater-Hernández, D., Fernandez-Llimos, F., Benrimoj, S. I. J. R. i. S., & Pharmacy, A. (2013). Defining professional pharmacy services in community pharmacy. *9*(6), 989-995.

Murray, M. D., Loos, B., Tu, W., Eckert, G. J., Zhou, X. H., & Tierney, W. M. (1998). Effects of computer-based prescribing on pharmacist work patterns. *Journal of the American Medical Informatics Association*, *5*(6), 546-553

Patra, S. (2019). Questionnaire design. In *Methodological issues in management research: Advances, challenges, and the way ahead*. Emerald Publishing Limited.

Sa'ati, A. (1991). *Simplifying the writing of scientific research from bachelor's, master's, and even doctorate* (In Arabic). Cairo: Saudi Center for Strategic Studies.

Saghaeiannejad-Isfahani, S., Saeedbakhsh, S., Jahanbakhsh, M., & Habibi, M. (2015). Analysis of the quality of hospital information systems in Isfahan teaching hospitals based on the DeLone and McLean model. *Journal of education and health promotion*, 4.

Samara, M. (2021). *Enabling and Restricting Factors That Affect the Adoption of Electronic Health Records (EHRs) in the Palestinian Public Healthcare System* (Master dissertation, An-Najah National University).

Singer, A., & Duarte Fernandez, R. (2015). The effect of electronic medical record system use on communication between pharmacists and prescribers. BMC family practice, 16(1), 1-6.

Sweidan, K. M. (2016). *Factors Affecting the Word of Mouth on Telecommunication Services Providers in Amman* (Doctoral dissertation, Middle East University).

Sayles, N. B. (2013). *Health information management technology: An applied approach* (p. 686). L. L. Gordon (Ed.). Chicago, USA: American Health Information Management Association.

Ta, L. (2022). *ANALYSIS AND PROPOSALS FOR IMPROVEMENT OF ELECTRONIC MEDICAL RECORD (EMR) AND ELECTRONIC HEALTH RECORD (EHR) SYSTEM* (Doctoral dissertation, California State Polytechnic University, Pomona).

Tropp, H. S. (2003). Hopper, Grace Murray. In *Encyclopedia of Computer Science* (pp. 786-788).

Van der Aalst, W., Hinz, O., & Weinhardt, C. (2019). Big digital platforms: growth, impact, and challenges. *Business & Information Systems Engineering, 61*, 645-648.

van Tongeren, J. M., Harkes-Idzinga, S. F., van der Sijs, H., Atiqi, R., van den Bemt, B. J., Draijer, L. W., ... & Borgsteede, S. D. (2020). The development of practice recommendations for drug-disease interactions by literature review and expert opinion. *Frontiers in pharmacology*, *11*, 707.

Zwass, V. (2022, December 15). *information system*. *Encyclopedia Britannica*. *https://www.britannica.com/topic/information-system*