Computerised Health Information System Implementation in Jordan, a Developing Country

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Abstract

Background and Purpose

Many factors promote or hinder the development and implementation of computerised health information systems (HIS) in the Hashemite Kingdom of Jordan, a developing country. This study explores these factors, and identifies the benefits of and barriers to this system. While the collection of health information is routinely undertaken by health workers, many studies show that very little of this data is used by health staff. Therefore, the main goal of this study is to explore the factors that promote or hinder the development and implementation of computerised HIS in developing Arab countries. The study uses Jordan as an example, to explore the major factors affecting computerised HIS and offer suggestions on how to improve the use of these systems, as well as improve healthcare more generally. Five factors were identified as affecting the development and implementation of a computerised HIS: the functional factor, the organisational factor, the technical factor, the managerial factor, the cultural factor and the legal factor.

Method

This study addresses computerised HIS in Jordanian hospitals, using a mixed-methods approach. The mixed-method design is a stratified, cross-section explanatory sequential design. First, the design used quantitative resources for data collection and analysis, to detect the factors promoting or hindering the development and implementation of a computerised HIS in Jordan. Next, qualitative data was collected and analysed to detect any other factors not addressed by the quantitative approach. An in-depth interview was conducted after the quantitative approach.

Findings

The study's findings are presented in two ways, according to the data collection method: quantitative findings and qualitative findings. The qualitative method was used to address factors, benefits or barriers in the development and implementation of a computerised HIS in Jordanian hospitals that were not mentioned in the quantitative method. The qualitative results were consistent with the quantitative results. The results are arranged in three major sections. The first concerns the factors promoting or hindering the development and implementation of computerised HIS. The factors promoting this system are mentioned in the study: the functional factor, organisational factor, technical factor, managerial factor, cultural factor and legal factor. Only three items hindered the development and implementation of a computerised HIS. The second section discusses the benefits of the development and implementation of computerised HIS, under two categories: clinical benefits and organisational benefits. The last section outlines the three barriers to the development and implementation of computerised HIS: lack of healthcare staff training, shortage of computers and equipment and the availability of program updates.

The factors that promote or hinder the development and implementation of computerised HIS in a developing country, such as Jordan, are the same factors that affect it in developed countries. The benefits and barriers are also the same, because the main goal of computerised HIS in every country is the same: to improve the quality of healthcare.

I dedicate this thesis to

The soul of my best friend and brother I fund him in this life

Qasem Agel (Abu Yousef)

My Parent, my wife Um Hashem , my family and my friends for their constant support and unconditional love.

I love you all dearly.

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First thing, I cannot find the suitable words to thanks my GOD for everything, but I will thank Him forever with GOD willing.

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List of Abbreviations

APA: American Psychological Association

ATSI: Aboriginal and Torres Strait Islander

CHIS: Clinical Health Information Systems

EMR: Electronic Medical Record

GDP: Gross Domestic Product

HDI: Human Department Index

HIS: Health Information System

HIT: Health Information Technology

HMIS: Health Management Information System

HREC: Human Research Ethics Committee

HSS II: Health Systems Strengthening Project II

ICT: Information Communication Technology

IS: Information System

IT: Information Technology

JH: Jordan Hospital

KAUH: King Abdullah University Hospital

KHMC: King Hussain Medical City

MOH: Ministry of Health

PHH: Prince Hamzah Hospital

RMS: Royal Medical Services

SD: Standard Deviation

SPSS: Statistical Package for the Social Sciences

USA: United States of America

WHO: World Health Organization

Definitions of Basic Concepts

Developing and developed countries: Countries whose per-capita income is low/high by world standards are considered developing/developed countries, respectively. Developing countries are synonymous with less-developed countries. Also, countries with low and high levels of development, according to some criteria. As the term 'developing country' is usually used, it does not necessarily connote that the country's income is increasing. There is contention and fierce debate regarding which countries are classified as developing and developed. Economic criteria have tended to dominate discussions. One such criterion is income per capita: countries with low gross domestic product (GDP) per capita are thus described as developing, those with high GDP as developed. Another economic criterion is industrialisation. Countries in which the tertiary and quaternary sectors of industry dominate are described as developed. The Human Development Index (HDI), which combines an economic measure and national income, with indices for life expectancy and education, has recently become prominent (Organisation for Economic Co-operation and Development & World Health Organisation (WHO), 2013). Developed countries are those with a high HDI rating, developing a low HDI rating.

Electronic health record: The aggregate electronic record of health-related information on an individual, which is created and gathered cumulatively across more than one healthcare organisation, and managed and consulted by licensed clinicians and staff involved in the individual's health and care (Harman et al., 2012; WHO, 2004).

Electronic medical record (EMR): An electronic record of the health-related information of an individual that is created, gathered, managed and consulted by licensed

clinicians and staff from a single organisation, who are involved in the individual's health and care (Harman, Flite & Bond, 2012; WHO, 2004).

Healthcare systems: Healthcare information systems are 'a prerequisite for coordinated, integrated, and evidence informed health care' (WHO, 2002).

Health informatics: Health informatics, healthcare informatics or medical informatics are at the intersection of information science, computer science and healthcare. They deal with the resources, devices, and methods required for optimising the acquisition, storage, retrieval and use of information in health and biomedicine. As well as computers, health informatics tools include clinical guidelines, formal medical terminology and information and communication systems. They are applied to nursing, clinical care, dentistry, pharmacy, public health and (bio)medical research (Winter et al., 2011; WHO, 2000).

Health information system (HIS): 'A functional entity within the framework of a comprehensive health system to improve the health of individuals and the population, it is a management information system (MIS)' (Hurtubise, 1984, p. 15). A system that integrates data collection, processing, reporting and use of the information necessary to improve health service effectiveness and efficiency, through better management at all levels of health service (WHO, 2000).

Health management information system: An information system specially designed to assist in the management and planning of health programmes, as opposed to delivery of care (WHO, 2004).

Information system: A system that provides information support to the decision-making process at each level of an organisation (Hurtubise, 1984).

System: A collection of components that work together to achieve a common objective (WHO, 2000).

Chapter 1: Introduction

1.1 Background

Health information systems (HIS), also called healthcare information systems, are defined as: 'A functional entity within the framework of a comprehensive health system to improve the health of individuals and the population, [they are] a management information system' (Hurtubise, 1984, p. 15). The World Health Organization (WHO) also defines healthcare information systems as 'a prerequisite for coordinated, integrated, and evidence informed health care' (WHO, 2002).

HISs deal with processing data, information and knowledge in healthcare environments in two ways. First, in integrated care, HISs focus on organising healthcare in a patient-centric way, in which it is necessary to provide relevant information in multiple ways. Second is institutionally, wherever and whenever needed. Therefore, we differentiate between institutional (e.g., hospital) and trans-institutional HIS, such as healthcare networks (Ter Burg, 2010). HISs are also a combination of vital and health statistical data from multiple sources, used to derive information on the health needs, health resources, use of health services and outcomes of use of people in a defined region or jurisdiction (Farlex, 2012).

HISs are a comprehensive information systems dealing with all aspects of information processing in hospitals. They are integrated, computer-assisted systems designed to store, manipulate and retrieve information on administrative and clinical aspects of service provision within a hospital (WHO, 2013). As systems that integrate data collection, processing and reporting, HIS are used to improve health service effectiveness and efficiency through better management at all health service levels (WHO, 2000). It is a critical that all hospitals collect, store and use information in a way that will allow them to improve services.

The first form of HIS was the medical record, developed by Hippocrates in the fifth century BCE, in order to improve healthcare processes (Greene, Saunders & Wilson, 2005; Jackson et al., 2009). Computerised HISs have been used in many countries, and the benefits of the system have prompted the keeping of medical records (Greene, et al., 2005; Jackson et al., 2009). Earlier, patients' information was kept on paper, an inefficient system in terms of improving healthcare processes as it was slow, and patient files could be lost after discharge (Jackson et al., 2009). In the 1960s, medical informatics developed. Researchers began to apply informatics using electronic medical records (EMRs) in large academic medical centres. EMRs developed in the 1980s, creating new ways of storing patient information. Electronic records of health-related information on an individual are created, gathered, managed and consulted by licensed clinicians and staff from a single organisation, who are involved in the individual's health and care (Harman et al., 2012; WHO, 2004). The EMR system greatly improved healthcare processes, and the development of more efficient computers resulted in the creation of better HIS, as all hospital departments could collect and share information quickly. According to the WHO (2004), the next stage in computerised HIS improved the quality of healthcare processes in hospitals more than developments in previous years. HIS have now been implemented in many countries.

HIS development began with the idea of the health management information system (HMIS). HMIS are specially designed to assist in the management and planning of health programmes, rather than the delivery of care (WHO, 2004). Health informatics, or healthcare informatics, is the intersection of information science, computer science and healthcare. It deals with the resources, devices and methods required for optimising the acquisition, storage, retrieval and use of information in health and biomedicine. As well as computers, health informatics tools include clinical guidelines, formal medical

terminology and information and communication systems. Health informatics is applied to nursing, clinical care, dentistry, pharmacy, public health and (bio) medical research (WHO, 2000).

Health information collection is routinely conducted by health workers to support effective healthcare processes. However, many studies show that very little collected data is used by health staff (Mair et al., 2012; Struder, 2005). Health information should be collected, analysed and used to support and improve the healthcare system and healthcare management, so the importance of a computerised HIS in hospitals after these systems are implemented, such as the improvement of the quality of the health processes, and contain the costs of the healthcare processes for hospitals (Braa & Hedberg, 2002; Heeks, 2006; Mair et al., 2012).

There are numerous uses for health information communication technology (ICT), from diagnosis to prescription and clinical care (Chandrasekhar & Ghosh, 2001; Mair et al., 2012). There has been rapid growth in computerised HIS, used by healthcare professionals and managed by ICT. There are many types of computerised HIS, including administration systems that contain patient information, history, treatment and appointments, as well as systems that manage multiple diagnoses (Mair et al., 2012). The use of HIS has many benefits, including accuracy of information, speed of access, access to multiple information resources and management of large amounts of data (Herrick, Gorman & Goodman, 2010). Health managers, physicians, nurses, administrators and other healthcare staff have welcomed HIS, as they help them achieve an increased quality of healthcare (Mair et al., 2012). However, the implementation of HIS has met mixed reactions (Al-Yaseen, Al-Jaghoub, Al-Shorbaji & Salim, 2010; Mair et al., 2012). Some healthcare staff are unhappy using computerised HIS, as they fear disruption to their work, the high cost of implementation, poor quality healthcare and poor usability. Such

negative reactions encouraged this researcher to focus on the major purpose of implementation and development of HIS (Bradley & Pekny, 2008; Oak, 2007).

Developed countries began using computerised HIS in the early 1980s (Braa, Monteiro, & Sahay, 2004; Walsham & Sahay, 2006). In developing countries, the implementation process began slowly due to cultural factors, such as resistance to change, as well as because of insufficient resources (Walsham & Sahay, 2006). Developing countries, such as the Hashemite Kingdom of Jordan (Jordan), face several constraints in their use of HIS, such as insufficient funding for the improvement of healthcare processes in hospitals, little ICT experience or support and training of healthcare workers (Ajluni & Maswadey, 2007; Braa, et al., 2004; WHO, 2004).

In the field of HIS, numerous studies have been conducted. These focus on the assessment of implementation on individual, group and organisation levels. Research at the individual and group levels explores factors controlling the acceptance and adoption of technology among individuals or groups (Downing, 1999). Research at the organisation or inter-organisation levels examines the diffusion of technological innovation in an organisation and beyond (Kaplan, 1997; Lorenzi & Robert, 2000). Different research questions prompt different research methodologies. The studies tend to analyse three components: normative, factor and process. The normative approach explores difficulties encountered during the implementation process. However, such studies are often incomplete in their description or characterisation of problems, and in proposing a methodology for successful implementation (Ginzberg, 1978).

Many studies have been based on the interaction between technology, people, tasks and organisational structure (Kaplan, 1997). Much research has also been conducted on creating a better conceptual image of HIS implementation, with the aim of raising the competency and efficiency of institutions. Previous research has included HIS

implementation case studies (Bagley, Snyder-Halpern & Staggers, 1999; Charles, Southon, Sauer & Dampney, 1997; Payton, 2000) and discussion of problems, as well as factors for success or failure (Ash, 1997; Charles et al., 1997; Hwang & Thorn, 1999; Lorenzi & Robert, 2000; Southon, Sauer & Dampney, 1999).

Other studies have emphasised the role of user satisfaction (Downing, 1999). The continuous advancement of information technology (IT), especially in the healthcare environment, has led IT, healthcare and medical informatics researchers to apply other methods to the assessment of information systems. Ginzberg (1978), states that objectivists use quantitative approaches on their subjects, while subjectivists use qualitative approaches. A multi-method approach has been formulated to assess information systems at a single site (Kaplan, 1997). However, to date, there has been no empirical research on information system implementation that follows Newman's (1994) suggestions, or that stems from the political consequences of system failure or the competitive value of success.

In the 1960s and 1970s, many information systems, including HIS, were unsuccessful or unable to achieve their goals. This drew the attention of Lucas (1978), who studied the implementation of the technology. Wetherbe (1988) supported and understood the complexity and importance of HIS implementation, emphasising that: 'Unfortunately, one of the least understood and most overlooked issues of information systems is implementation' (Wetherbe, 1988, p. 237).

It is important to research the adoption of new IT trends in healthcare organisations, as well as in other fields, as IT implementation is complex and takes time, money and effort. The risk of failure is reported to be greater than 30 per cent in cases of the implementation of large-scale HIS (Charles et al., 1997). In an attempt to lower the risks, many healthcare organisations have turned to software package solutions (Charles

et al., 1997). In theory, this should ensure that reliable, robust system implementation is undertaken, with full utilisation and involvement, leading to user satisfaction and continuum of care.

Many organisations have faced, and continue to face, barriers to implementing HIS. Most implementation problems are related to behaviour rather than technology, as introducing new health IT in hospitals requires change (Kaplan, 1997; Lorenzi & Robert, 2000). The complexity of HIS necessitates an in-depth systemic approach to implementation, to ensure the effective introduction of IT in the healthcare sector.

1.2 HIS in Developing Countries: The Case of Jordan

Jordan's health system is a complex amalgam of two major public programmes, the Ministry of Health (MOH) and Royal Medical Services (RMS), which both finance and deliver care. Some smaller public programmes, including several university-based programmes and a large private sector, also fund and deliver care (Ajluni & Maswadey, 2007).

Jordan's healthcare system is considered advanced, although most health services are concentrated in the capital, Amman. It is divided into public and private sectors. In the public sector, the MOH operates 31 hospitals, or 37 per cent of all hospital beds in Jordan. Twelve hospitals are for the military's RMS, constituting around 24 per cent of all hospital beds. The private sector covers around 36 per cent of all hospital beds; in 2011, there were 61 private hospitals (Department of Statistics, 2010; Library of Congress, 2006).

The implementation of computerised HIS began around eight years ago in Jordan, in both the private and public sectors. Since then, computerised HIS has grown rapidly and is used by healthcare workers and managed by ICT. This new development can help hospitals provide better service (Al-Yaseen et al., 2010).

1.3 Research Problem

Jordan's MOH aimed to implement computerised HIS in all hospitals, to improve healthcare processes. However, since 2007, not all hospitals have done so, due to financial problems and cultural factors, such as a lack of openness to change (Ajluni & Maswadey, 2007). To date, only two studies have attempted to assess HIS in Jordan (Al-Yaseen et al., 2010; Ajluni & Maswadey, 2007;), making this study of the implementation of computerised HIS timely.

Previous research has found that the development and implementation of computerised HIS is affected by many factors, which ultimately improves or hinders it (Al-Yaseen et al., 2010; Jeffrey, 2012; Struder, 2005). The healthcare information system in Jordan is continuously responding to changing demographics, the epidemiological and risk profiles of the population, the rising expectations of an increasingly educated population, the quickly growing private health sector, the rapid changes in medical technology and the government's desire to expand services and achieve universal health coverage (Ajluni & Maswadey, 2007).

The primary concern of this thesis is the development of computerised HIS in the Jordanian hospitals that have already implemented them, as well as those that have yet to do so, to improve the quality of healthcare processes in all Jordanian hospitals. The factors promoting or hindering the development and implementation of computerised HIS in Jordan are unknown. Therefore, this research will identify those factors. This will allow the appropriate, systematic promotion and control of these factors, to support and improve healthcare systems and management.

Jordan's healthcare system performs relatively well in terms of overall access and outcomes, but it faces many problems that require the attention of health sector policy makers. Such problems include the increasing population, rapid advances in health

technology and rising healthcare costs (Al-Yaseen et al., 2010; Library of Congress, 2006). Generally, there is low-level HIS use and management of information in Jordanian hospitals, and very few studies have focused on HIS in poor or developing countries, such as Jordan (Al-Yaseen et al., 2010; Ajluni & Maswadey, 2007).

1.4 Aim of the Research

The main aim of this study is to identify the factors promoting or hindering the development and implementation of computerised HIS in Jordan. Jordan, as a developing Arab country, is used as a case study to explore the procedures, tools and problems related to healthcare information collection, storage, use and information flows. Such exploration will identify the major factors affecting computerised HIS, and offer suggestions on how to improve the use of these systems. This thesis aims to improve healthcare and computerised HIS more generally.

1.5 Research Questions

1. What are the factors promoting the development and implementation of computerised HISs in Jordan?
2. What are the factors hindering the development of computerised HISs in Jordan?
3. What are the benefits of developing and implementing computerised HISs in Jordan?
4. What are the barriers to implementing computerised HISs in Jordan?
5. What effect do participants' backgrounds have on their responses to the questionnaire on factors promoting or hindering the development and implementation of computerised HIS in Jordan?

1.6 Objectives of the Research

1. To explore the functional, organisational, technical, managerial, cultural and legal factors affecting computerised HIS in Jordanian hospitals.
2. To explore the engagement of healthcare professionals with computerised HIS in Jordanian hospitals.
3. To explore and evaluate the benefits of implementing computerised HIS.
4. To explore and evaluate the barriers to implementing computerised HIS.
5. To explore healthcare staff's perceptions towards computerised HIS in their clinical work and patient care.
6. To evaluate the effect of computerised HIS on patient outcomes, as perceived by healthcare staff.

1.7 Importance of the Study

As a developing country, health information collection in Jordanian hospitals is routinely undertaken by health workers using paper files, and very little of this collected information is used by the professional healthcare staff. When information exists in a computerised system, it may be easier to use (Al-Yaseen et al., 2010). HIS can support improvements in healthcare processes, so it is important for this study to examine the implementation of computerised HIS in Jordanian hospitals, in order to detect the factors affecting the development of such systems.

Healthcare costs in Jordan have increased annually, affecting the quality of care (Ajluni & Maswadey, 2007). This study also focuses on cost containment and benefit factors, by attempting to improve computerised HIS usage and positively affect healthcare processes in Jordan. This study identifies improvements that could be made to the quality of healthcare in Jordanian hospitals. For example, it is suggested that the introduction of computerised HIS in hospitals will decrease annual healthcare costs, as

well as treatment time. Applying HIS in the right ways is likely to lead to improvements in the quality of healthcare in Jordan, as demonstrated in other developing countries (Mair et al., 2012). This research identifies the appropriate control process to allow these factors to develop. These issues will be examined in more detail in the following chapter, by exploring the current literature on computerised HIS. The literature will help identify the gaps and methods required in order to study these issues.

1.8 Outline of the Thesis

The thesis consists of six chapters. This chapter has introduced the problem. Chapter 2 presents a comprehensive literature review, providing an understanding of the research on HIS principles, HIS types, health information management, HMIS, information and communication technologies. The literature review explains health informatics, and the developing stages of health informatics. Next, the chapter focuses on the literature on the benefits of and barriers to the implementation of computerised HIS. The final section of the literature review discusses HIS in Jordan, as well as in other developing and developed countries. The theoretical framework used in this study is organisational theory, applied through the scientific management approach.

In Chapter 3, a mixed-methods approach, using both quantitative and qualitative methods, is described. No single method is sufficient to discern the important elements of an evaluation of the implementation of computerised HIS. Therefore, both quantitative and qualitative approaches were taken. A quantitative approach (the questionnaire) was applied during fieldwork with healthcare workers, and aimed to detect the factors that promoted or hindered the development and implementation of computerised HIS in Jordan, and the benefits of and barriers to such implementation. The qualitative component provided a detailed understanding of the healthcare workers' perspectives, especially their response to the implementation of computerised HIS. A major aim of

using the qualitative method was to discover any new factors promoting or hindering the development and implementation of computerised HIS in Jordan, which had not been communicated in earlier literature or in the questionnaire used in this study. The researcher directly engaged with health facilities, and was thus able to ensure the accurate collection of data. The questionnaire and interview were undertaken in the four main MOH hospitals in Jordan.

Chapter 4 presents the quantitative results and is divided into two sections. The first presents the factors promoting or hindering the development and implementation of computerised HIS, and the second the benefits and barriers that arise after the implementation of this system in Jordanian hospitals. Chapter 5 presents the qualitative results, and, like Chapter 4, is divided into two sections, each addressing the same issues. This was conducted in order to determine whether any factors or benefits not mentioned in the quantitative results arose.

Chapter 6 summarises the result through a discussion of the quantitative and qualitative results, and draws conclusions from these findings. This chapter also covers the recommendations and limitations of the study.

Chapter 2: Literature Review

2.1 Introduction

This chapter critically reviews the literature on computerised HIS. The first section focuses on HIS and their historical development. This includes three main processes: HIS and their management, types of HIS and HIS in developing countries. The second section includes literature on computerised HIS and ICTs, including telemedicine as an example. This section also discusses a variety of issues, such as health informatics. This section concludes by examining literature on computerised HIS in developing countries, including examples from selected developing countries. It also discusses issues that have emerged from the development and implementation of computerised HIS. This chapter examines the factors promoting or hindering the development and implementation of computerised HIS, and concludes with the major benefits of such systems. The concluding section discusses the literature in which decision-making, cost containment and the improved quality of healthcare are compared and contrasted, regarding computerised HIS.

2.2 HIS

The main purpose of medical records is to serve as repositories of clinicians' observations and analyses of patients (Hersh, 1995). Clinicians' recorded interactions with patients usually begin with the history, daily progress notes and physical examination (Hersh, 1995). The EMR emerged after the benefits of medical records had been observed (Greene, et al., 2005; Jackson et al., 2009).

Until recently, the use of electronic health records in developing nations was thought to be unrealistic (Harman et al., 2012). In many places, discarding paper-based records and replacing them with an electronic system may not be simple or appropriate. It

can be difficult to convince concerned parties of the necessity of shifting from a known paper-based system to an unknown electronic system (Jackson et al., 2009).

Computerised HIS or HMIS can improve the quality of health services (Wesley, 2006). Healthcare managers and providers cannot optimally allocate resources, improve health service quality or address epidemics or chronic diseases without reliable, relevant health information (Siddamallaiah, 2013; Wesley, 2006). Worldwide, health systems are being restructured according to the demand for information (Wesley, 2006). The skill required in using and managing information is also increasing. All countries must implement national, computerised HMIS using modern ICT (Wesley, 2006). It is necessary to link the different levels of the health system and discover the information needs of managers, staff, service providers, policy makers and patients (Wesley, 2006; Wesley, 2006).

The steps in implementing an HIS management structure (Lippeveld, 2000; Winter et al., 2011) are as follows:

1. Define information needs and indicators.
2. Determine sources of data and instruments for data development.
3. Develop data processing and transmission.
4. Guarantee the use of the information system.
5. Plan for the present and future needs of computerised HIS resources.
6. Put new organisational rules in place to develop computerised HIS.

Computerised HIS must provide comprehensive data to health professionals, from birth to death data, morbidity and mortality data, and quality of clinical services. It must also provide population indicators, such as socio-economic and demographic statuses (WHO, 2008). Five domains can be derived from this information (see Figure 2.1) (WHO, 2008). These are:

1. Health determinants, such as risk factors of disease, and socio-economic and demographic statuses.
2. Health system inputs, such as policihuman resources and hospital organisation.
3. Health system outputs, such as the quality and availability of health information.
4. Health system outcomes, such as service utilisation.

   Health status: the other four domains working together to provide the best health status, such as control over morbidity, decreased mortality and the general population's wellbeing.

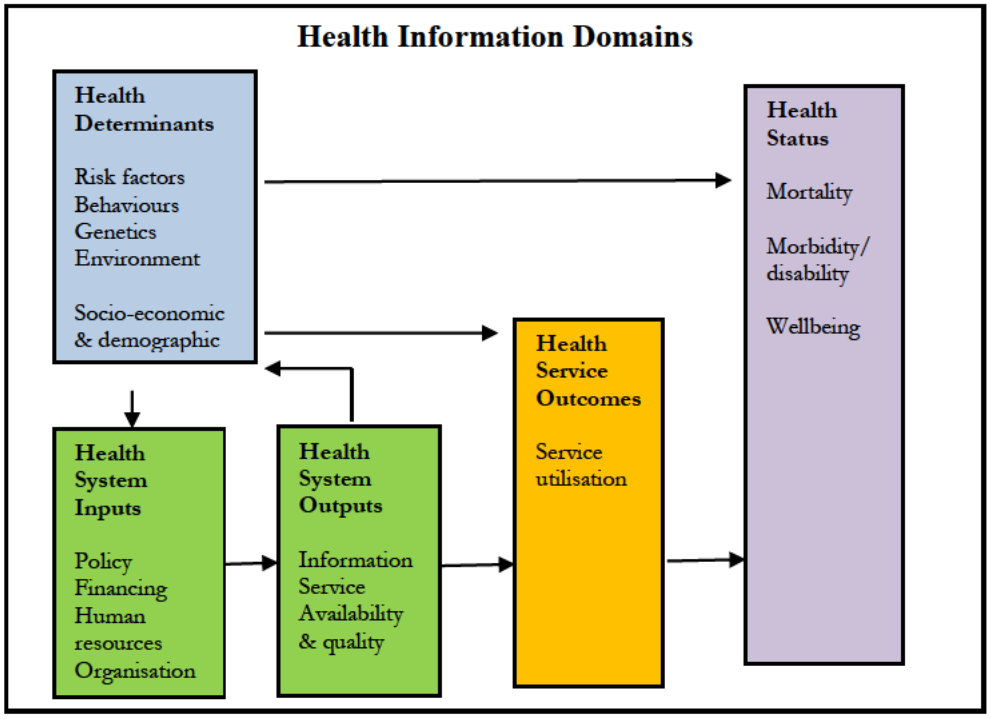

Figure 2.1: Health information domains.

2.3 HIS Types

Information processes in computerised HIS start with data collection, so the classification of HIS is according to the type of data collection employed. There are two basic ways to collect data: routinely and periodically (non-routinely). Periodic data

collection usually means conducting surveys, which initially appear to be expensive. However, they involve one-time costs, and may be less expensive long-term than routine data collection (Mair et al., 2012; Ties, 1991).

Computerised HIS is classified into two types. The first type is clinical HIS (CHIS), typically large and complex, and applies to large hospitals. CHIS focus on patients' specific information, such as EMRs (Littlejohn, Wyatt, & Garvican, 2003). Such sophisticated systems, often found in large hospitals, are difficult to create in developed and developing countries (Heeks, 2001; Littlejohn, Wyatt, & Garvican, 2003). CHIS integrate effective technology platforms, so there are many benefits to this type of system. These include easy access to relevant patient healthcare and administrative information at the point of delivery, and improved access to health information in hospitals, which improve patient safety, increase the quality of care and reduce medical errors and the length of hospital stay (Heeks, 2001; Littlejohn, Wyatt, & Garvican, 2003).

The second type is routine health information systems. These derive information at regular intervals of one year or less, through mechanisms designed to meet predictable information needs. They are called 'Potomac Sub-factor', a method of investing in routine health information, especially in developing countries. This investment meets local or national health needs (Littlejohn, Wyatt, & Garvican, 2003).

2.4 HIS and Management Information Systems

Various definitions of HIS were mentioned in Chapter One. The WHO (2000) defines HIS as systems that integrate data collection, processing, reporting and use of information necessary to improve health service effectiveness and efficiency, through better management at all levels of health service.

The structure of a computerised HIS should specify how the required information is generated, for use in the decision-making process at all levels of the health system with

the available resources (Shrestha & Bodart, 2000; WHO, 2004). The structure of computerised HIS can be described as a set of interrelated constitutive elements collated under two large components: the information process and the health information management structure (Lippeveld, 2000; Wesley, 2006). The components are data collection, transmission, processing and analysis; and presentation of information used in health service management decisions and patient care. In general, to make computerised HIS processes effective, an HMIS structure is needed, to guarantee that resources are used in a way that produces information of a high quality (Lippeveld, 2000; Mair et al., 2012).

2.5 HMIS

The widespread use of computerised HIS and other information sources—including hospital administrative functions and information from human resources, health informatics and health IT—is increasing in information management practice in the health sector (Karen W., 2009). The HMIS structure consists of the following components: HIS resources, including persons (managers, statisticians, epidemiologists) and data collectors); supplies (registers, telephones, computers, report forms, data processing programs and financial resources); and a set of organisational rules (diagnostic and treatment standards, definitions of workers' responsibilities, supply management procedures and computer maintenance procedures). All components work together to ensure the efficient use of computerised HIS resources (Karen W., 2009; Lippeveld, 2001). For the HMIS structure, the organisational level goes from local to national. Each of these levels has a specific function that requires specific decisions, ultimately intended to improve healthcare processes. For example, HMIS provide healthcare workers the information necessary for decision-making at each level, with continuously-changing planning and management needs (Karen W., 2009; Lippeveld, 2001).

2.6 HIS and ICT

HIS and ICTs were developed simultaneously. For many years, limited ICT capacity meant that computerised HIS were not properly developed. However, as ICT became more efficient, computerised HIS became more sophisticated. Computerised HIS is based on levels of general information, and the communication technology infrastructure available in particular settings. The expectation that ICT would improve health in developing countries derives from three sources (Chandrasekhar & Ghosh, 2001). The first is the use of ICT as an instrument for lifelong learning and continuing education, to help healthcare workers in developing countries be educated and trained in the use of computerised HIS. This depends on a progression in knowledge, because when staff are knowledgeable about the benefits of computerised HIS, healthcare process quality will increase. The second source is the use of ICT as a delivery mechanism for various services to disadvantaged and remote locations. This can vary from improved public health education to the provision of emergency advice, including advice on dealing with natural disasters. The third source is the potential to use ICT ‘as a mechanism to increase the efficiency and transparency of governance which would, in turn, improve the delivery and availability of publicly provided health services’ (Chandrasekhar & Ghosh, 2001, p. 852).

2.7 Healthcare Informatics

In the past decade, a variety of definitions of healthcare informatics have emerged (Ross & Chung, 2006). Most focus on the breadth of use of computers, information technology and communications in healthcare (Friede & McDonald, 1995; Ross & Chung, 2006; Whetton, 2005). Health information technology (HIT) is ‘the application of information processing involving both computer hardware and software that deals with

the storage, retrieval, sharing, and use of healthcare information, data, and knowledge for communication and decision making' (Whetton, 2005).

Healthcare informatics has emerged as an important new field of study, broadly defined as the way in which healthcare can be improved. In the health field, informatics are comprised of four areas (Friede & McDonald, 1995; Ross, 2006; Whetton, 2005). These areas are medical informatics, public health informatics, consumer health informatics and bioinformatics.

The main aim in the application of healthcare informatics is to improve the quality of healthcare and increase productivity, as well as to provide access to knowledge. This new development gives rise to the concept of health informatics (Mair et al., 2012; Ross & Chung, 2006).

2.8 The Historical Development of Health Informatics

In the 1950s, bioinformatics began to develop in large mainframe computer systems in government institutions (Winter et al., 2011). By the 1960s, medical informatics developed, wherein researchers applied informatics using EMRs in large, academic medical centres (Englebardt & Nelson, 2002; Ross & Chung, 2006; Winter et al., 2011). Public health informatics began in the 1990s, through the emergence of graduate public health programmes in the United States of America (USA) (Ross & Chung, 2006; Winter et al., 2011). Health informatics was concerned with patient data and the characteristics of disease in population and health programmes. It was important to public health concerns, regarding surveillance systems and the tracking of community diseases (Ross & Chung, 2006; Winter et al., 2011).

The final stage was the development of consumer health informatics in 1990, following the rapid growth of the Internet (Fitzmaurice, Adams & Eisenburg, 2002). Millions of new users became connected to the Internet, and tens of thousands of new

Internet sites were developed. All sites collected and provided data on disease, health prevention activities and medical treatment. There was a revolution in healthcare, which encouraged and allowed the public to understand their health problems and medical conditions. This revolution helped people better communicate with health professionals, giving them a more active role in treatment (Englebardt & Nelson, 2002; Hersh, 2002; Ross & Chung, 2006).

2.9 HIS in Developing Countries

Developed countries such as the USA, Germany and the United Kingdom (UK) used computerised HIS by the 1990s, which was earlier than in developing countries (Braa, et al., 2004; Walsham & Sahay, 2006). The uptake was slower in developing countries, due to cultural aspects, such as resistance to change, and because of insufficient resources (Walsham & Sahay, 2006). Various studies discussed the political and social context of organisations in developing countries (Braa, et al., 2004; Lippeveld, 2000; Walsham & Sahay, 2006). Culture is often ignored in the development process, despite having a great effect on how systems work. This is especially important when people unfamiliar with a culture are involved in the organisation or development of a system of change (Avgerou, 2002; Braa, et al., 2004). Culture also varies within many countries, meaning that culture should be understood through immersion in context, and not considered a barrier to technological or organisational development. For example, without external financial and technical assistance, most developing countries cannot afford to rely on periodic data collection to generate information (Isabalija et al., 2011). Culture should not be seen as a barrier to the development or implementation of a computerised HIS (Walsham & Avgerou, 2001; Walsham & Sahay, 2006).

Social systems are integral to the development of HIS in developing countries. One problem of informality: the implementation of computerised HIS in developing

countries is often less formal than in developed countries. Further, fewer computers and little ICT experience, support or training can be problematic, and require establishment during the development process (Braa, et al., 2004; Walsham & Avgerou, 2001). For example, a typical scenario involving computerised HIS implementation in developing countries includes 40 people, 10 units and one computer (Braa, et al., 2004; Walsham & Avgerou, 2001; WHO, 2004).

Health institutions and hospitals must have sufficient funding in order to improve the quality of healthcare processes. One major problem for implementation is insufficient funding for the purchase of computers and other equipment, meaning that attempts to implement such systems have failed in many hospitals in various countries (Isabalija, Mayoka, Rwahana & Mbarika, 2011; Mair et al., 2012). In both developed and developing countries, governments are often responsible for hospital budgets and for providing hospitals and health sector institutions with yearly funding to improve healthcare provision (Isabalija et al., 2011). In developing countries, governments often do not provide adequate funding, which can mean the lack of development and implementation of computerised HIS (Carmine & Daniel, 2007; Isabalija et al., 2011; Kouroubali, 2003; Mair et al., 2012).

2.10 The Health Sector in Jordan

Jordan's health system combines two major public programmes—the MOH and the RMS—both of whom fund and deliver care. Some smaller public programmes, including university-based programmes and a large private sector, also fund and deliver care (Ajluni & Maswadey, 2007). HIS in Jordan is evolving and continually responding to changing demographics, the population's epidemiological and risk profiles, the rising expectations of an increasingly educated population, a quickly growing private health sector, rapid changes in medical technology and the government's desire to expand

services and achieve universal health coverage (Al-Yaseen et al., 2010; Ajluni & Maswadey, 2007).

2.11 HIS in Jordan

HIS in Jordan is considered advanced, although most health services are concentrated in Amman (Ministry of Health (MOH), 2011). In 2011, government health expenditure was 7.5 per cent of GDP. Expenditure of approximately 9.3 per cent of GDP is considered high by international health organisation standards, and the human department index was low (MOH, 2011). The healthcare system is divided into the public and private sectors. As stated earlier, the MOH provides around 37 per cent of all hospital beds in Jordan, while the military's RMS provides around 24 per cent and the university hospitals around three per cent. The private sector provides around 36 per cent of all hospital beds, and in 2011, 61 private hospitals were operated by the MOH (MOH, 2011). In 2007, the Jordan Hospital (JH) was the biggest private hospital in the country, and was the first private hospital to receive JCI AS international accreditation. Treatment costs in Jordanian hospitals are lower than in other developing countries (Department of Statistics, 2010; Library of Congress, 2006).

Jordan is recognised as providing one of the highest standards of healthcare in the Middle East (Ajlouni, 2011). It also has a rapidly growing IT sector, which increases respect for and recognition of the country in the Arab world (Ajlouni, 2011). Computerised HIS was first implemented at the Prince Hamzah Hospital (PHH), highlighting its open-source CHIS and computerised patient record system (MOH, 2011). Similar technology systems are to be implemented in the private sector, at the Amman Comprehensive Clinic and King Hussein Cancer Center, as part of the pilot healthcare transformation programme for Jordan, announced in December 2008. As of 2010, the

same systems were still in place, and had not yet been further developed (Ajlouni, 2011; MOH, 2009).

King Abdullah II's vision for the health sector was to continue to build on successes by establishing an effective, integrated national healthcare infrastructure using a single software program, such as platform software, by implementing the Hakeem project of computerised HIS in all health sectors (Electronic Health Solutions, 2014). This project will help build an educational programme focused on technical and clinical processes, with the goal of allowing Jordan to become self-sustainable in managing its HMIS, and enabling it to take this expertise to neighbouring Arab nations (Ajlouni, 2011; Dua'a, Othman & Yahya, 2012). The Hakeem project team recently provided an update on what has been accomplished since the project started in 2008, and provided a guide to how the system works (Dua'a et al., 2012; MOH, 2009). The team highlighted system functionality, including a graphic user interface developed especially for the Hakeem project. It also highlighted EMRs, using a holistic electronic patient record that clinicians will access daily; the interaction between the various modules of the system in different departments, including emergency, pharmacy, the laboratory and all hospital departments; and improvement in the quality of healthcare and patient safety. The Hakeem project and the integrated healthcare technology system—implemented for the people of Jordan—is meant to symbolise the National E-Health Program in Jordan, managed by the Jordanian non-profit agency Electronic Health Solutions, with technology implementation and integration (Ajlouni, 2011; Dua'a et al., 2012; MOH, 2009; WHO, 2009).

Jordan has one of the fastest growing populations in the world (WHO, 2009; United Nations Economic and Social Commission for Western Asia, 2013). In between the censuses conducted in 1979 and 1994, the population grew from 2.1 to 5.1 million, an average increase of 2.7 percent annually, and was predicted to be 7.1 million in 2012

(WHO, 2013). At this rate of growth, the population of Jordan will double in 25 years. The Government of Jordan has recognised that this will place tremendous strain on the natural resource base (MOH, 2013).

Jordan's focus has been on developing its human potential, essentially by advancing the wellbeing of its citizens. This includes maintaining a low infant mortality rate and high life expectancy, which are among the best in the region (WHO, 2013). Population growth continues to be a major constraint on development, especially when analysed in light of the quantity and quality of services necessary to accommodate the increased population. Jordan faces several other issues, including a less than fully-functional public health system and a significant increase in chronic diseases (MOH, 2013).

Jordan's Health Systems Strengthening Project II (HSS II) was funded by the United States Agency for International Development for five years, and was due to be completed in 2014. Its purpose is to improve the quality of the healthcare system through the MOH. The HSS II project works to enhance the health system by activating structural and administrative changes within Jordan's public health system.

2.12 Challenges Facing Jordan's Health System

As noted earlier, Jordan's health sector performs well in terms of access and health outcomes, which are among the best in the region and among other middle-income countries. About 70 per cent of Jordanians have formal health insurance coverage. Services are delivered through an extensive network of public and private facilities, and overall capacity—in terms of hospital beds and physicians—is high. While the system performs relatively well in terms of overall access and outcomes, it faces many serious challenges that require the attention of health policy makers and managers. The following

specific challenges were identified in a joint MOH/WHO report on health strategies (Library of Congress, 2006; MOH & WHO, 2001):

1. Demographic changes representing an increase in population and higher life expectancy.
2. Considerable changes in lifestyles, favouring the development of determinants and risk factors for chronic disease, accidents, injuries and substance abuse.
3. Epidemiological transition and changes in the patterns of disease, characterised by a progressive increase in the magnitude of chronic conditions, including cardiovascular diseases, cancer, diabetes and mental health problems, as well as accidents and the health of the elderly.
4. Inefficiencies observed in the provision and financing of health services.
5. A lack of a rigorous appraisal (and reorientation) of the current state of human resources development in health.
6. The negative effect of poverty on access to quality healthcare, particularly in view of the high proportion of uninsured people.
7. Increasing demands and expectations of the public for effective and accessible healthcare.
8. Rapid advances in technology and rising healthcare costs.
9. Inadequate coordination between the public sector and the increasingly significant private sector, and the lack of effective systems for monitoring and auditing clinical practice.
10. Emerging environmental health issues.

2.13 Implementation of HIS

Computerised HIS was radically different in the early 1980s, when the use of computers in hospitals and healthcare environments increased (Mair et al., 2012). Since then, improvements in computer speed, networks and the Internet have led to the increased availability and accessibility of information for healthcare staff, to help with decision-making processes (Fraser & Blaya, 2010; Mair et al., 2012; Rose, Schnipper, Park & Poon, 2005; Vimarlund, Olve, Scandurra & Koch, 2008).

Both computerised HIS and ICT-based applications for the collection and exchange of clinical health information have presented solutions to patient problems, through the collection of all patient data (Ammenwerth et al., 2004; Friedman & Wyatt, 2006; Mair et al., 2012; Timpka, Bang, Delbanco & Walker, 2007). The implementation of computerised HIS in the health sector affected organisational change in two ways. First, through the installation of the program, and second, in the ways in which the program was used. These changes were part of organisational change, which were undertaken at both group and individual levels (Kouroubali, 2003). In a meta-analytical study, Rahimi, Vimarlund and Timpka (2009) found that the implementation of computerised HIS in hospitals was the main action of implementation of these systems. They also found that the implementation of computerised HIS will not automatically increase the organisational efficiency of work processes, and that computer technology will only gradually enter daily life. The implementation process of this system was affected by many factors between 1990 and 2009, including organisational, economic and social factors (Fraser & Blaya, 2010; Mair et al., 2012; Rahimi et al., 2009).

The implementation of computerised HIS in any country faces many difficulties. The first is the technological challenge of appropriate access to the necessary standardisation of information. Other difficulties include organisational, managerial and

technological issues, as well as cultural barriers and issues related to decision-making in hospitals (Croll, 2009). Computerised HIS can improve the effectiveness and efficiency of healthcare processes (National Committee on Vital and Health Statistics, 2001; WHO, 2002). However, the implementation of computerised HIS is sometimes resisted by users of the system (Croll, 2009).

In the past, system failures caused by the complexity and unpredictability of computerised HIS implementation made it difficult to enact technology-based change (Goldstein, 1995; Kaplan, 1997). Now, the complexity and unpredictability of computerised HIS has disappeared, due to the systematic way that they are implementation and developed. Computerised HIS have been implemented for computer-based patient records in hospitals, to improve the quality of patient care and improve the efficiency and safety of all services (Mair et al., 2012; Rahimi & Vimarlund, 2007).

The implementation of computerised HIS requires teamwork (Fraser & Blaya, 2010; Kudyba, 2010; Mair et al., 2012). Gathering a suitable team ensures the successful transfer of new work processes and encourages support for improved clinical decisions. The team must represent all hospital departments and healthcare workers, and be included in all phases of implementation, to ensure that implementation centralises care for the patient (Kudyba, 2010). There are four phases in the implementation of computerised HIS. The first is selection, allowing healthcare workers to see that the system works and is being used by other healthcare workers. The second is design, the best opportunity for healthcare workers to understand the new process. That means that the newly-implemented system includes technology that redesigns workflow practices. The third phase is system implementation, or ‘going live’. This phase focuses on training healthcare workers to use the new system. The final phase is optimisation, allowing the team to evaluate the implementation of the new program, and monitor the accuracy and

completeness of health information by auditing healthcare staff satisfaction (Kudyba, 2010; Mair et al., 2012).

The spread of computerised HIS in hospitals and other healthcare environments should yield financial benefits (Eisenstein, Ortiz, Anstrm & Lobach, 2008; Rahimi & Vimarlund, 2007). The outcomes of HIS implementation in many hospitals and primary care centres have not yet met all expectations (Garde et al., 2007; Heeks, 2006; Mair et al., 2012; Rahimi et al., 2009).

In computerised HIS implementation, actions such as surveillance of the system's effectiveness and the motivations of healthcare workers are required (Fraser & Blaya, 2010; Rahimi et al., 2009). The inclusion of needs assessment provides a medium-term action, as well as medical staff training, work routine and workflow integration, and educational support for all healthcare workers during the implementation process. Assessment of day-to-day use, involvement and participation, technical system performance and trust are factors that must be considered during the implementation of computerised HIS (Fraser & Blaya, 2010; Mair et al., 2012; Rahimi et al., 2009).

All previous studies discussed here addressed the implementation and development of computerised HIS in hospitals and the health sector, on which multiple factors played a part. The positive and negative effects of these factors will be discussed in the following section.

2.14 Factors Promoting or Hindering the Development and Implementation of Computerised HIS

The development and implementation of computerised HIS holds great promise for improving efficiency, but it can also result in unforeseen costs and organisational consequences, and even failure (Anderson & Aydin, 2005; Buntin, Matthew, Michael & Blumenthal, 2011). Implementation should be done wisely, with attention paid to

organisational and technological issues (Anderson & Aydin, 2005; Carmine & Daniel, 2007; Mair et al., 2012). Improved safety and quality of healthcare, reduced costs, efficiency, effectiveness and patient care are factors that should be considered when any healthcare organisation wishes to implement a new HIS (Andersen & Aydin, 2005; Buntin et al., 2011; Chismar & Thomas, 2004; Mair et al., 2012).

Computerised HIS implementation may encounter a gap between conception and reality. Such gaps are associated with response changes (Heeks, 2006; Mair et al., 2012). Managers must control and accept such changes, and healthcare workers can assist with implementation, allowing it to succeed. The link between the size of change and the number of benefits depends on many factors, which positively or negatively affect implementation (Heeks, 2006; Mair et al., 2012). Healthcare is increasingly mediated by technology, and the implementation of CHIS represents a new era of technological possibilities. As more sophisticated systems to manage patient information become available, there is an increasing expectation that CHIS will achieve outcomes for systems, users, managers and patients. These outcomes, in turn, are expected to improve the efficiency and effectiveness of healthcare services (Heeks, 2006). The successful implementation of computerised HIS is critical to attaining the economic and competitive advantages that innovation offers, but it is not enough to understand the implementation process of CHIS, because efforts are often either incomplete or partial failures. In part, success may depend on the development of a better understanding of the factors affecting the success or failure of CHIS implementation (Carmine & Daniel, 2007; Mair et al., 2012; Struder, 2005). Predicting and controlling those factors will not, however, ensure that unpredictable results will be avoided (Carmine & Daniel, 2007; Goldstein, 1995).

The results of some studies highlight a number of major factors that result in the inefficiency of implementation processes (Carmine & Daniel, 2007). These are technical,

social and organisational factors (Heeks, 2006; Heeks, Mundy & Salazar, 1999; Mair et al., 2012). These factors begin with hospital or healthcare managers' lack of understanding of healthcare workers' needs. A failure to identify barriers to implementation can affect the success of the implementation process. Additionally, there are gaps between the expected and the achieved outcomes of implementation. This is clear from the actual experience of healthcare workers and hospital managers after the implementation of computerised HIS (Mair et al., 2012; Rahimi et al., 2009).

Factors affecting the adoption of computerised HIS in hospitals in developed countries include the hospital (or healthcare) market, organisational structure and financial structure (Chow, 2013; Wang, Wan, Bazzoli & Blossom, 2005; Wang, Wang & Moczygemba, 2014; Zhang et al., 2013). The actual application of a computerised HIS shows positive effects on efficiency, benefits and the quality of hospital healthcare through IT evaluation studies (Chow, 2013; Wang et al., 2005). HIS technology must be an integral part of implementation of computerised HIS in hospitals. A major aspect of successful HIS adoption in hospitals is understanding the method of application of technology in clinical procedures (Chow, 2013). It is also important to know how work practices will be affected (Bradley & Joseph, 2008; Leu et al., 2008; Mair et al., 2012).

The main factors determining the success or failure of computerised HIS are identified in the following sections. Six factors have been identified in the literature: functional, organisational, technical, managerial, cultural and legal (Benson, 2002; Brender et al., 2006; Carmine & Daniel, 2007; Chow, 2013; Mair et al., 2012; Rahimi et al., 2009; Wang et al., 2014; Zhang et al., 2013).

2.14.1 Functional factor.

There are two aspects to the functional factor—functionality and usability—with all sub-factors derived from these, including decision-making processes and the amount

of time and effort spent on implementing computerised HIS in hospitals (Bowdith, 2001; Carmine & Daniel, 2007; Frabotta, 2002; Mair et al., 2012). The functionality of implementation includes a number of components: comprehensive functionality, the various ways in which the system will be used, the balance between new functionality and stability, and user-tailored ICT (Bowdith, 2001). Other elements should be available, such as a functional process that allows healthcare staff to make decisions on staff needs, training, comprehensive data availability, accurate information, staff cooperation, sufficient equipment and adequate human resources. Stakeholder influences also exist in hospitals, such as doctors and nurses, who are important in the decision-making process surrounding the implementation of computerised HIS. Medical decision-making will be accurate and fast, depending on the data available in the HIS of the hospital (Carmine & Daniel, 2007; Mair et al., 2012; Nussbaum, 1998).

The usability of computerised HIS requires a good fit between user and system. Ideally, they will have an intuitive user interface with few screen options. Computerised HIS in hospitals should ensure that the working processes between healthcare workers are smooth and clearly understood. It would be advantageous if computerised HIS were seen as a valuable use of time and effort (Carmine & Daniel, 2007; Mair et al., 2012).

2.14.2 Organisational factor.

There are three aspects to the organisational factor: historical context, costs and benefits and the system's support of work processes (Carmine & Daniel, 2007; Kotter, 2007; Mair et al., 2012; Wang et al., 2014). The historical context identifies any previous positive experiences, with new ways of working for ICT users (Carmine & Daniel, 2007; Wang et al., 2014). Any change associated with the implementation of computerised HIS must be considered to improve working arrangements (Carmine & Daniel, 2007; Mair et al., 2012). A successful HIS should connect groups of healthcare professionals and

respond to their needs, with decision-making processes designed around their work practices. It is important that the availability of high quality information is an outcome. In the absence of good information, decision-making must be made with more basic models and individual experiences (Health Information Systems Knowledge Hub, 2009; Mair et al., 2012; Wang et al., 2014).

Organisationally, the security and cost of using computerised HIS must be ascertained (Isabalija et al., 2011). This important factor includes positive views of cost-benefit perceptions, user security and effects on patient care. Patients must also feel the benefits of HIS, and technology must balance the outcomes of the expectations for ICT. The high cost of implementing computerised HIS and hospital services are important factors affecting the success of their implementation in the public health sector (Isabalija et al., 2011).

The implementation process in hospitals enhances and supports the security of patient information in two ways. First, it does so by giving each healthcare worker in a hospital a user name and password for the system, in order to check or insert information on a patient's page. The system can therefore automatically detect which employee is inserting the information. This is one way of reducing medical errors, by double-checking any medical order or action performed by healthcare workers. The second way that security is enhanced is that the use of computerised HIS is restricted, which is reassuring for patients, reducing any fear over their private information being shared with others (Frabotta, 2002; Isabalija et al., 2011; Mair et al., 2012; Wang et al., 2014). Computerised HIS protect and control patient privacy while health information data is being used (Agaku, Adisa, Yusuf & Connolly, 2014).

Computerised HIS must support work processes, in order to decrease routine documentation activities, support the core care of patients and support routine clinical

tasks through the ICT, by making these activities easier. These support factors do not make many changes to workload or work organisation because processes require a long time to change completely. Sharing suggestions between healthcare workers in the decision-making processes, when implementing computerised HIS, supports the success of the adoption, implementation and development of the system. Management should ensure that support is provided to clinical leaders and others in two ways: identifying HIS needs through goal setting or strategic planning, and motivating the decision-making process (Carmine & Daniel, 2007; Frabotta, 2002).

2.14.3 Technical factor.

Three technical factors promote or hinder the implementation of computerised HIS and determine the implementation process' degree of success. They are the development, technology and architecture of the system (Brender et al., 2006; Carmine & Daniel, 2007; Mair et al., 2012). For the development factor, it is important to establish small teams to ensure continuous user involvement and sufficient expertise in computerised HIS and healthcare processes, and to use and identify standard uses of the system. The introduction of computerised HIS must increase the information available to health staff and initiate information transfer to the organisation (Kouroubali, 2003; Mair et al., 2012).

For the technology factor, stability must be ensured. The system should use affordable technology that is not too complicated, and devices must be easy to use. The implementation of computerised HIS should provide opportunities to improve daily work. Healthcare staff should be encouraged to adopt new ways of utilising technology in their practice (Kouroubali, 2003; Mair et al., 2012). The architecture of the system must be flexible, modular and stable. There must be good interoperability and integration between other ICTs and computerised HIS, and the system must be easy to use. The third technical

factor is the ability to update hardware and software. The installation of a computerised HIS in a hospital is generally more complicated than the installation of software or the setting up of a personal computer. Due to the complexity of installing and updating computerised HIS, it takes time for hospitals to install new programs (Chaudhry et al., 2006; Herrick et al. 2010; Mair et al., 2012).

2.14.4 Managerial factor.

The managerial factor comprises three sub-factors: sufficient funding, the education and training of healthcare workers and the flexibility of project management implementation (Brender et al., 2006; Carmine & Daniel, 2007; Chow, 2013). There must be sufficient funding for the implementation of computerised HIS, and during the process, computers and other equipment must be adequate (Mair et al. 2012). If the equipment is insufficient for the needs of the healthcare staff, implementation will not be successful, and healthcare staff will feel inadequately prepared (Kouroubali, 2003; Wang et al., 2014). Further, a shortage of computers and software can be a barrier to the implementation of HIS (Isabalija et al., 2011). Governments in both developing and developed countries have a role to play in providing their health sector with appropriate funding and incentives for the adoption of new HIS, by procuring new and sufficient computers for hospital departments (Carmine & Daniel, 2007; Mair et al., 2012).

Regarding the managerial factor, staff must be skilled, adequately trained and sufficiently educated in the use of computerised HIS, and extensive support for users must be provided (Isabalija et al., 2011; Mair et al., 2012). In this way, the managerial factor focuses on the education of all healthcare workers, for the implementation of new systems in their workplaces (Kouroubali, 2003). The participation by healthcare workers during and after implementation is essential. The most important thing is the education of healthcare workers, and training in the use of computerised HIS. Their degree of training

and participation in activities relates to the success of this technology (Kouroubali, 2003; Mair et al., 2012). Other research has shown that a lack of training support for healthcare workers in the use of computerised HIS affects the implementation of such systems in developing countries (Carmine & Daniel, 2007; Chow, 2013). The private sector focuses on training and supporting healthcare workers to use computerised HIS, but a lack of knowledge about using them has negatively affected both the public and private sectors (Carmine & Daniel, 2007; Isabalija et al., 2011; Mair et al., 2012).

The flexibility of project management implementation and public relations require consideration. There must be high staff motivation regarding the project, and all tools of the project must be used. An important managerial factor is the minimisation of interpersonal tensions within the project team (Mair et al., 2012). A lack of flexibility during implementation of computerised HIS is one factor that has a sustained effect on its success or failure.

The managerial factor can lead to problems with satisfaction among healthcare workers. The four types of health worker satisfaction are:

1. Satisfaction with the quality of HIS interface.
2. Satisfaction with the way the computerised HIS functions.
3. Satisfaction with the performance of the computerised HIS.
4. Satisfaction with the way the computerised HIS combines all three of the above factors (Carmine & Daniel, 2007; Isabalija et al., 2011; Mair et al., 2012).

For example, health workers should be satisfied that the documentation time is acceptable, and that they have access to the information when and where required, by using the computerised HIS (Amin, Hussein & Wan, 2011; Mair et al., 2012).

2.14.5 Cultural factor.

The cultural factor contains two sub-factors: organisational culture and openness to change (Benson, 2002; Brender et al., 2006; Carmine & Daniel, 2007). An important element of culture is the presence of individuals who promote the system with vision, form a support base for change, support various user groups and who believe in the project. The most critical organisational cultural factor affecting the implementation of computerised HIS is resistance to change from healthcare workers. New systems require engagement with new processes, and many remain satisfied with the original methods, such as using paper files (Isabalija et al., 2011; Mair et al., 2012).

Openness to change is necessary, to ensure that new systems are accepted for care delivery. There must be alignment between individual and institutional goals, and not with the independent professional status of users. This idea is associated with the understanding that the implementation of computerised HIS will motivate change. If healthcare workers start accepting implementation by understanding the system's benefits, cultural resistance will likely disappear. It must be understood and accepted that one of the major benefits of computerised HIS is improved healthcare quality, including improved work quality for staff. The adoption of computerised HIS should motivate change, which can help the system succeed (Carmine & Daniel, 2007; Heckley, 2004; Mair et al., 2012).

2.14.6 Legal factor.

The required legislation must be appropriate (Benson, 2002; Brender et al., 2006). Legal issues are important in promoting and developing computerised HIS, so those responsible for creating legislation must be experts in ICT and health systems. The main aim of legal work is to promote healthcare processes (Benson, 2002; Brender et al., 2006; Carmine & Daniel, 2007; Mair et al., 2012). The major legal factor affecting the

implementation of computerised HIS is the lack of policy, guidelines or penalties for using them, particularly in hospitals. The lack of governmental support for using and implementing such systems, as well as the lack of laws protecting computerised HIS practitioners in developing countries, are important elements of the legal factor (Carmine & Daniel, 2007; Isabalija et al., 2011).

The six main factors promoting or hindering the development and implementation of computerised HIS, as discussed, are functional, organisational, technical, managerial, cultural and legal aspects. These include sub-factors. All factors have positive or negative effects, and these are discussed in the following section.

2.15 Benefits of Computerised HIS

Many benefits to healthcare workers can be had by implementing computerised HIS: improved cost containment, increased timeliness and accuracy of patient care and administrative information, increased service capacity, reduced personnel costs and inventory levels, increased efficiency, greater availability of information and improved patient care quality (Croll, 2009; Glaser & Drazen, 1986; Mair et al., 2012). However, these benefits do not automatically follow the implementation of such systems. Operational problems may diminish information timeliness, accessibility and accuracy; policies and procedures may not have been sufficiently tailored to reflect the realities and intent of the system; and personnel may not have been adequately restructured. To realise the full potential of information systems, healthcare organisations must plan for and implement strategies to maximise benefits (Croll, 2009; Glaser & Drazen, 1986).

The general and global effects of the implementation of computerised HIS in hospitals in developing countries is manifested in the increased efficiency of treatment processes for chronic diseases, and in the sharing of professional work through electronic documentation. The most important benefit is the reduction in healthcare costs (Isabalija

et al., 2011; McClure, 2007). An example of the future implementation of computerised HIS in healthcare is telemedicine (Chow, 2013; McClure, 2007). In this rapidly-developing application, medical information is transferred via the Internet, by telephone or through other networks. It is frequently used in consultations (Buntin, 2011; Isabalija et al., 2011; Mishra, 2007).

A review of the literature on the use of HIT after the implementation of computerised HIS identified a number of positive effects for hospitals and all other health sectors (Buntin et al., 2011; Chaudhry et al., 2006; Mair et al., 2012). These benefits are improvements to the quality, safety, efficiency and cost effectiveness of healthcare delivery. Most studies that have assessed the implementation of computerised HIS in hospitals identified the positive effects on healthcare delivery as efficiency and effectiveness, patient satisfaction, safe practice, computerised decision support and healthcare staff satisfaction (Buntin et al., 2011; Chaudhry et al., 2006; Mair et al., 2012).

The benefits of computerised HIS implementation usually begin slowly, until HIT becomes integrated into the standard work of patient care. Electronic prescriptions are one of the many benefits of using computerised HIS in hospitals. This can reduce adverse drug events, improve the quality of healthcare and decrease the cost of treatment (Bradley & Joseph, 2008; Fischer, Vogeli, Stedman, Ferris & Weissman, 2008). Computerised HIS facilitate healthcare and treatment processes for patients in many ways, such as when physicians or other medical staff can access information at any time and from any department using their user name and password. This process is less time consuming and reduces treatment costs. All of these changes should improve the quality of healthcare (Amin et al., 2011; Buntin et al., 2011; Chaudhry et al., 2006).

HIS are essential to improving the quality of healthcare, by supporting health decision-making in the treatment process, and computerised HIS should improve health

policies. In the health sector, decision-making processes occur in two steps. The first is ‘data led’, meaning that HIS data must contain the data determinants of health, the cost effectiveness of healthcare procedures and health interventions. The second step is ‘action led’, the action required for HIS. These two steps allow improved decision-making, which increases healthcare quality in hospitals (Buntin et al., 2011; Chaudhry et al., 2006; Panerai, 2000).

Computerised HIS in hospitals facilitate and improve patient care. For example, use of a systematic electronic appointment system reduces the time and effort of healthcare workers when dealing with patients. Electronic prescribing and other computerised HIS strategies improve patient safety, and facilitate patient care in all departments (Bradley et al., 2008; Chaudhry et al., 2006; Crosson et al., 2008; Mair et al., 2012).

Computerised HIS also effects health research and projects. The ability to use statistical information on diseases, new medications and new medical technology are all benefits of using the Internet, and improve the quality of healthcare delivery. For example, research utilising integrated data on medications for a patient’s treatment will produce information on which drug is best to treat a disease (Chaudhry et al., 2006; Herrick et al., 2010; Mair et al., 2012).

2.16 Barriers to HIS Implementation

Despite the benefits of computerised HIS in healthcare, there are many barriers to implementation, as discussed in the literature review (Bradley & Joseph, 2008; Lyons et al., 2005; Mair et al., 2012; Oak, 2007). The most significant barrier is system failure, particularly when computers stop working, making it difficult to access patient information records (Mair et al., 2012). A second major barrier is the high financial cost of implementing computerised HIS in hospitals. The excessive cost of antiquated HIS

used in hospitals is based on hospital income inequality and inadequate resources (Oak, 2007; Chinnock, 2004). The high cost of implementing computerised HIS processes and adopting HIT in hospitals may be another barrier. In using electronic prescriptions to reduce adverse drug events, if the underwritten financial costs of implementation are less than the real financial costs, implementation will fail (Bradley & Joseph, 2008; Lyons et al., 2005; Mair et al., 2012).

A third major barrier to the implementation of computerised HIS in both developed and developing countries are updating processes. The installation of computerised HIS in hospitals is more complicated than the installation of software on computers (Chaudhry et al., 2006; Herrick et al., 2010; Mair et al., 2012). The fourth barrier, in both developing and developed countries, is the protection of privacy, security and confidentiality, due to HIS access by those not eligible to do so (Croll, 2009; Littlejohn, Wyatt & Garvican, 2003). Often, there are no hospital polices relating to user name and password access, and any person can open patient files (Oak, 2007).

Other barriers are the poor quality of healthcare—which can lead to negligent practices—or cultural and sociological factors that play an important role (especially in developing countries) in workers' acceptance of computerised HIS (Mair et al., 2012). Professionals' inability to accept computerised HIS can lead to poor quality healthcare delivery in developing countries. The implementation of HIS will change work processes in hospitals, affecting the organisation and quality of care of health systems (Croll, 2009; Littlejohn et al., 2003; Oak, 2007; Mair et al., 2012). Another barrier is health workers' responses to and acceptance of new technology (Croll, 2009; Oak, 2007). Response to the new system—with or without training—will improve the efficiency of healthcare. However, some healthcare staff use computers to play games or search websites for fun, while some do not use them at all. Further, incomplete installation and inadequate

maintenance of computerised HIS can prevent their effective use (Kouroubali, 2003; Mair et al., 2012).

The challenges described in the earlier stages of system implementation highlight a lack of collaboration between healthcare workers (Rahimi et al., 2009). For example, many of the most significant failures in implementation derive from the absence of feedback from end users to developers during implementation and development (Mair et al., 2012; Pare, Sicotte, Jaana & Girouard, 2008; Rahimi et al., 2009).

In developing countries, lack of training and supervision has been found to be one of the most significant barriers to the implementation and development of computerised HIS. This has resulted in the inadequate collection of information and lack of healthcare workers' skills (Kimaro & Twaakyondo, 2005). For example, there are problems regarding the input of all information in the computerised HIS for producing different reports, as health facilities that did not report much information were not discovered. Healthcare managers did not share the data collected by healthcare workers (Braa, et al., 2004; Kimaro & Twaakyondo, 2005; Mair et al., 2012).

The lack of appropriate strategies for human resources is important, and lead to lack of healthcare worker skills and insufficient time for training and practice (Kimaro & Twaakyondo, 2005). Healthcare workers collect much routine information that other workers may need, rather than using the information in their own work, and the time allocated for training is not sufficient (Kimaro, 2006). If training does occur, it generally does so only once and is not followed up, or is seen as ineffective, and education provision is not considered suitable by healthcare workers (Kimaro & Twaakyondo, 2005; Mair et al., 2012). The lack in appropriate strategies wastes human resources, as evidenced by an absence of mechanisms to ensure sustainability (Kimaro, 2006).

Another barrier facing the implementation of computerised HIS in developing countries is poor data quality (Kimaro, 2006; Kimaro & Twaakyondo, 2005). This includes the entry of incomplete, missing, too much or inaccurate data into the system, and a lack of data validation caused by inadequate supervision (Braa & Hedberg, 2002; Kimaro & Twaakyondo, 2005). Many studies have demonstrated that the updating processes for computerised HIS during implementation in hospitals is considered one of the main barriers. Problems with updating may include a lack of antivirus software or other IT security mechanisms (Kimaro & Twaakyondo, 2005; Lungo, 2003; Mair et al., 2012; Mwangu, 2003).

Healthcare workers often have poor information because there is a lack of access to appropriate journal data or the Internet, especially in developing countries. This problem is being solved in large hospitals through increased access to Internet-based information in both developed and developing countries (Oak, 2007; Sluijs, Veeken & Overbeke, 2006).

2.17 Summary

The literature review on computerised HIS was divided into five sections. The first discussed the historical development of computerised HIS through three main processes: the management of HIS, the main types of HIS and HIS in developing countries. The second section focused on healthcare informatics and the development stages of health informatics, followed by the status of computerised HIS in developing countries. The third section examined healthcare, computerised HIS and challenges facing the implementation of computerised HIS in Jordan.

The fourth section discussed the factors promoting or hindering the development and implementation of computerised HIS. These consisted of six major factors, the first of which was the functional factor, which included the functionality of implementation,

and the fact that the usability of computerised HIS in hospitals requires a good fit between user and system. Second was the organisational factor, comprised of three elements: the historical context, identifying previous positive experiences with new ways of working for ICT users; the security of computerised HIS and the fact that the costs of implementation in hospitals must be ascertained; and that computerised HIS must support work processes, decrease routine documentation activities, support the core care of patients and routine clinical tasks through ICT, to make them easier. The third factor was the technical factor, which included the development, technology and architecture of the system. The fourth factor was the managerial factor, including three sub-factors: sufficient funding, education and training of healthcare workers and the flexibility of project management implementation. The fifth factor was the cultural factor, which included organisational culture and openness to change. The last factor was the legal factor, which focused on legislation enacted by staff who were experts in ICT and community health systems, to improve the quality of healthcare processes.

The final section focused on the benefits of and barriers to the implementation and development of computerised HIS. The major benefits are that computerised HIS can improve cost containment, increase the timeliness and accuracy of patient care and administration information, increase service capacity, reduce personnel costs and inventory levels, increase efficiency and the availability of information, and improve the quality of patient care. Conversely, several barriers prevent the implementation of computerised HIS: system failure, high financial costs, system updating processes, the protection of privacy and security, and weak responses to the new system without training.

Chapter 3: Research Methodology

3.1 Overview

This study is informed by the public health and health informatics fields. The research incorporates sociological and managerial approaches. Computerised HIS are not limited to curative and preventive measures; a managerial component must be present for better planning and to improve the quality of healthcare. This chapter provides an overview of the research methodology, from the theoretical approach and study design to the data collection and analysis, and the ethical considerations of the study.

3.2 Theoretical Approach

This study aimed to identify the factors promoting or hindering the development and implementation of computerised HIS in Jordanian hospitals. Contingent on the objectives of this study is the assumption that organisational theory can explain the classical perspective of the scientific management approach (Daft & Armstrong, 2009). Organisational theory with normative rules for the structuring of work was developed, in which organisations, workers, machines or instruments were constructed to meet the purpose determined by a project's objectives (Daft & Armstrong, 2009).

Four organisational theories have been postulated, which focus on task performance and structure. They are:

1. Scientific management, or Taylorism: a theory that analyses and synthesises workflows (Daft, 2007; Jorgen & Mille, 2006; Taylor, 1911).
2. Administrative theory: a theory that attempts to find a rational way to design an organisation as a whole (Jorgen & Mille, 2006; Thompson, 1956, as cited in *Administrative Science Quarterly*, p. 102; Daft & Armstrong, 2009).

3. Bureaucracy and organisational structure, which defines how activities such as task allocation, coordination and supervision are directed towards the achievement of organisational aims (Daft & Armstrong, 2009; Simon, 1947; Daft, 2007).
4. Administrative behaviour: a generic term describing the process by which people within organisations work (Daft & Armstrong, 2009).

This study uses scientific management, or the Taylorism theory (Taylor, 1911), which emerged from post-industrial Europe in the 19th century (Jorgen & Mille, 2006). Its main tenet is systemisation, whereby the focus is on achieving efficiency, standardisation and the simplification of procedures through scientific analysis and experiments (Jorgen & Mille, 2006; Kahneman, 2003). The starting point of scientific management is individual work processes and their consequences in the workplace, as well as the systems and structures adopted (Daft & Armstrong, 2009). The scientific management approach, it is argued, leads to increased productivity and a reduction in the level of stress and anxiety of workers through cooperation (Daft & Armstrong, 2009).

An example of scientific management in healthcare would be determining the amount of time it takes workers to complete a specific task, and establishing work patterns that decrease this time by eliminating potential waste. For instance, during initial admission to hospital, when medical staff conduct a patient history for their EMR using a computerised HIS, the treatment process would begin directly. But, if others also perform a medical history and gather information for the same patient, time is wasted, increasing the time to complete the process and limiting the treatment (Daft & Armstrong, 2009; Kahneman, 2003).

This thesis adopts the scientific management approach to elucidate the factors promoting or hindering the development and implementation of computerised HIS in

Jordanian hospitals, in order to improve the efficiency of healthcare processes and increase staff productivity. After an examination of these factors, they must be managed and controlled for, to ensure effective promotion and implementation. For example, patient information should be accurate and saved automatically so that it can be accessed at any time, even if the patient is readmitted to hospital after a long time. Also, the training needs of staff may be identified, and where required, a schedule of education be established to allow all staff to use the system effectively. To guide this process, a pragmatic approach will be used, with a deductive-inductive methodology (Johnson & Onwuegbuzie, 2004).

3.3 Study Design

A stratified, cross-sectional, exploratory, sequential mixed-method design was used (Creswell, 2009), in which the quantitative data was collected and analysed first (the deductive phase), followed by the qualitative data (inductive phase, see Figure 3.1). Interpretation of the data occurred separately for both the quantitative and qualitative findings. The two phases were analysed separately but then brought together to add depth to the outcomes, with the aim of ultimately offering suggestions for the better management of these factors and encouraging greater productivity and efficiency for patients in Jordanian hospitals.

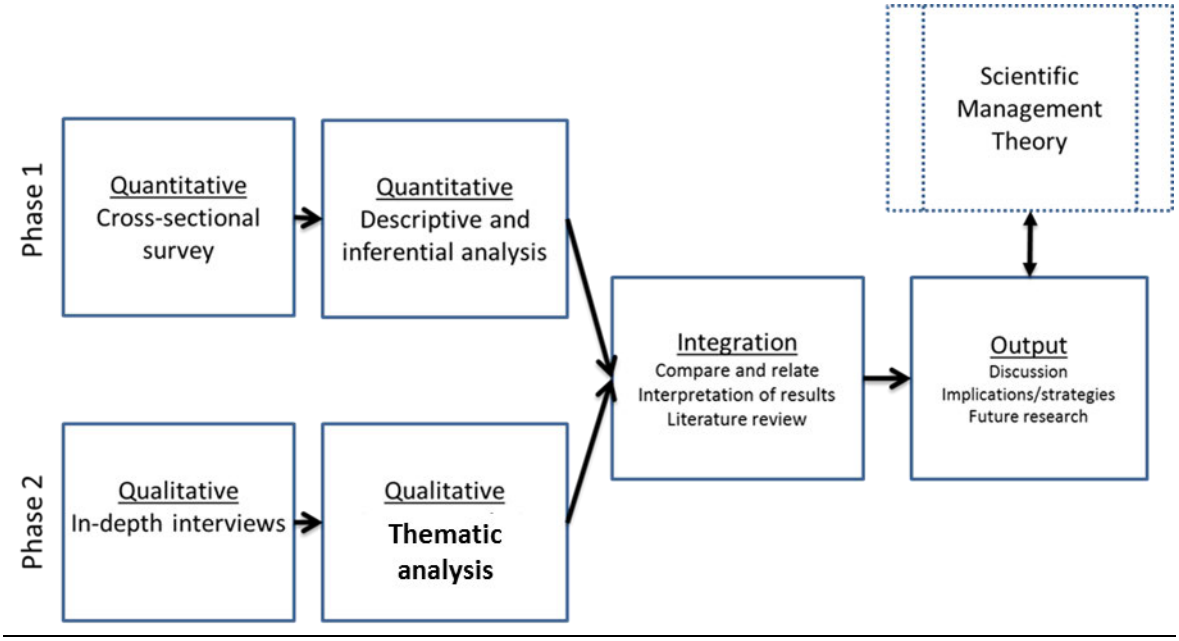

Figure 3.1: Study design.

The steps of the deductive approach were: identification of a theory, hypothesis, observation through data and information, and confirmation of the theory (Gill & Johanson, 2010). The inductive approach was the reverse: observation, recognition of a pattern, production of a tentative hypothesis and generation of a theory.

As stated, this study aimed to establish the perceived usability of HIS, and the factors affecting implementation, through evidence of need in hospitals, medical centres and health departments. This design enabled the researcher to better understand the interplay and interaction of factors, and so generate potential improvements in the development and implementation of a computerised HIS.

3.4 Setting of the Study

This study was conducted in Jordan, a country bordered by Saudi Arabia to the south and east, Iraq to the north-east, Syria to the north and Israel and the State of Palestine to the west. Provisional results of the 2013 population and housing census estimated Jordan's population to be 6.5 million, with a population growth rate of 2.7 per cent and life expectancy of 57 years (Jordan Government, 2013).

Four sectors provide healthcare in Jordan; in 2013, there were 104 hospitals—31 run by the MOH, 61 private, two university and 11 run by the military (MOH, 2013; RMS, 2013). In this study, one large hospital from each sector was included, to ensure a representative sample. Each hospital was selected because it represented the largest from each of the four healthcare sectors that had implemented computerised HIS for more than five years. The four hospitals were PHH (MOH), JH (private), King Hussain Medical City (KHMC, military) and the King Abdullah University Hospital (KAUH).

This study examines the factors identified in previous studies to assist professional healthcare staff in Jordanian hospitals deal with computerised HIS, in order to control for and manage these factors and improve healthcare. Data collection took four to six months.

3.5 Population and Sample

The selection of an appropriate sample size for statistical analysis is essential in survey research, to ensure good statistical power and confidence in the results (Cohen, 1988). The use of a sample size that is too small could result in the omission of important findings, but the use of relatively large sample size could result in waste of time and resources. An optimal or minimum number of cases are required to realise a study's aims and objectives (Cohen, 1988; Kevin et al., 2014).

This study's participants were healthcare workers in hospitals, including hospital and department managers, physicians, nurses and other health staff working in HIS, such as medical records employees. Health care workers were invited to participate in the study if they met the inclusion and exclusion criteria. Hospitals were included if they were the largest in each sector, had used HIS for at least five years and if they distributed the questionnaire on healthcare professionals according to the percentage of professional healthcare staff. Healthcare staff participants were included if they had at least diploma-

level education and were at least 25 years old. The population from which the study could be drawn was 73348 (Table 3.1).

Table 3.1

Health sector employees in 2011

	MOH	RMS	Education sector	Private sector	Total	Per cent per 10,000 of population
Physicians	3973	1460	399	9504	15336	25.5
Nurses	10074	5149	718	21912	37853	38.1
Managers & department managers	1695	947	204	4305	7151	13.1
Other health professionals	6029	1732	514	14733	23008	23.3
Total	21771	9288	1835	50454	73348	100

The population for this sample was 6700, drawn from the total staff of the four selected hospitals (Table 3.2).

Table 3.2

Breakdown of employees by hospital

	PHH	KHMC	KAUH	JH	Total
Physicians	343	516	399	116	1374
Nurses	659	1112	718	227	2716
Managers & department managers	184	387	204	65	840
Other health professionals	389	741	514	126	1770
Total	1575	2756	1835	534	6700

The minimum sample size, using a probability sampling technique, was 384 participants. In this study, the researcher aimed to recruit up to 650 participants, to ensure that the minimum was reached. This number of questionnaires was chosen because the response rate in developing countries can be low. In a previous study in Jordan that evaluated the post-implementation of health care information systems, the total response rate was only 31.6 per cent (Al-Yaseen et al., 2010). The distribution of questionnaires to

the healthcare professionals depended on the percentage of such professionals in Jordanian hospitals in the four health sectors. The average staff percentage in Jordanian hospitals at the time of research was 15.6 per cent for managers and departments managers, 16.3 per cent for physicians, 40.5 per cent for nurses and midwives and 27.6 per cent for other health staff (medical records employees, pharmacists, laboratory technicians and X-ray staff) (MOH, 2013). The decision was made to distribute the same number of questionnaires to each hospital, and to apply the same ratio across the health professionals surveyed. The Arabic-language surveys were distributed to 40 hospital and department managers, 80 physicians, 300 nurses and 120 other health staff. Each hospital was allocated 162 or 163 surveys, with a minimum of 96 required from each hospital.

3.6 Response Rate

Of the 650 questionnaires distributed, 540 were returned. The respondents demonstrated positive interest in this research. The overall response rate was almost 83 per cent. From PHH, 128 responses were gathered, with 131 from KHMC, 146 from KAUH and 134 from JH. The response rate ranged from 78 per cent to 90 per cent (Table 3.3).

Table: 3.3

Sampling response rate and percentage of participants per hospital

Hospital	N	n	Response rate (%)	Participants (%)
PHH	163	128	78	23.7
KHMC	163	131	80	24.3
JH	162	134	83	24.9
KAUH	162	146	90	27.1
Total	650	540	83	100

This sample size was calculated using the following formula:

Sample size:

$$SS = \frac{Z^2 * (p) * (1-p)}{c^2}$$

$$SS = \frac{(1.96)^2 * (0.5) * (1- 0.5)}{(0.05)^2}$$

SS = 384

Where:

Z = Z value (e.g., 1.96 for 95 per cent confidence level)

p = percentage picking a choice, expressed as decimal

(0.5 used for sample size needed)

c = confidence interval, expressed as decimal

3.7 Data Collection

3.7.1 Measurement tool.

Items for the survey included three questionnaires from previous studies (Al-Hajerri, 2006; Brender et al., 2006; Lippeveld, et al. 2000). The survey questionnaire was developed and validated by the researcher. Face validity was established by six experts, the factor and construct validity ascertained *post hoc*, and the final analysis adjusted accordingly. The research methods included selection of the research population, selection and modification of questionnaire to meet the needs of the study, *post hoc* testing of the survey and modification for the final analysis as necessary and distribution of questionnaires and analysis of results.

This questionnaire consisted of seven sections (see Appendix A). These were:

- Section 1*:* demographics (age, gender, education level and professional group).
- Sections 2 to 6*:* factors promoting or hindering the development and implementation of HIS. This was divided into six factors: organisational (with 23 sub-factors), functional (four sub-factors), managerial (four sub-factors), technical (two sub-factors), legal (three sub-factors) and cultural (four sub-factors).
- Section 7*:* benefits and barriers to the use of computerised HIS.

The scale used in the survey utilised a five point Likert scale, with the following responses: strongly disagree, disagree, neither agree nor disagree or neutral, agree, strongly agree.

Five specialist Arab doctors currently working in the local health system translated the survey from English to Arabic, to ensure the cultural adaptation of the survey for Arabic-speaking Jordanian participants. Brender et al. (2006) established a new questionnaire to investigate the factors affecting HIS that is reliable ($\alpha = 0.8$) and

valid. This is the first time this tool has been used to determine the factors in a developing country.

In addition to the demographic and personal variables, six questions with 25 items were used in the survey, using nominal or categorical scales: gender (two choices, male and female), age, education level and job title (four categories) and work department and work experience in the hospitals (six categories).

Survey sections two to eight covered all factors that may have either positive or negative effects on a person's use of computerised HIS, as described in previous studies, and to detect the barriers and benefits of such systems for the improvement of the quality of healthcare in Jordan.

3.7.2 Interviews.

Qualitative data collection consisted of interviews, to allow interpretation of the factors affecting computerised HIS uptake in Jordanian hospitals. The researcher generated questions for the interviews with hospital and department managers, nursing directors, physicians and managers of computerised HIS departments, all with at least ten years' experience. The researcher conducted 16 interviews with four participants from each hospital. The interviews used open-ended questions and took place in an informal manner during work time, and were conducted in either English or Arabic, depending on the language of the participants (see Figure 3.2).

Qualitative methods provide details from healthcare professionals in their own words on the use of computerised HIS. The semi-structured interviews aimed to collect information from participants on the research hypotheses (Burgess, 1995; Mertens, 2008).

3.7.3 The major interview questions.

As with the survey, the interview questions were derived from previous studies (Brender et al., 2006; Carmine & Daniel, 2007; Littlejohn, Wyatt, & Garvican, 2003; Struder, 2005).

Can I ask you about the advantages and problems in the development and implementation of the computerised healthcare system (HIS) in your hospital?

Based on the main objectives of this study, the interview addressed the following questions:

1. What problems do you experience related to data collection, report preparation and information flows from health facilities to higher levels?
2. What are the factors promoting the development and implementation of the computerised HIS in your hospitals?
3. How is patient healthcare data collected?
4. What are the tools used to collect and store (record) collected data?
5. How is healthcare data being kept and managed over time?
6. Where is the collected data sent?
7. Which of the collected data are used?
8. Who uses the data, and what are they used for?
9. How is patient information shared?
10. What are the factors hindering the development and implementation of a computerised HIS in your hospital?

Figure 3.2: Qualitative interview questions.

3.8 Validity and Reliability

In this study, a *post hoc* principal component factor analysis was conducted on the six major factors, which confirmed a six factor structure. However, the items previously associated with each factor needed to be rearranged into the derived structure. The factor names were retained; with possible alternative names proffered (the new names are provided in parentheses). They are organisational (acceptability, 23 items), functional

(usability, four items), managerial (technical requirements, four items), technical (evidence-based practice, two items), legal (policy, three items) and cultural (access, two items). The results appear in the table below. While the strength of the original factors was reasonably maintained, it was considered best to reorganise them into more meaningful factors to suit the population.

Table 3.4

Factor analysis

Factor	Item	Loading
1 Organisational factor (acceptability)	The changes introduced with the computerised HIS have importance for my daily work	.545
	I find all the information I need	.584
	The information is comprehensive	.657
	Data I register are important for patient care	.546
	The computerised HIS is easy to use	.552
	I have access to the information where I need it	.624
	The time I use for documentation is acceptable	.494
	I am certain about the reliability of the data documented	.542
	I have received adequate training for the use of the HIS	.256
	I find the HIS user-friendly	.559
	The computerised HIS is worth the time and effort required to use it	.627
	My patient care decisions are based on the computerised HIS recommendations	.475
	I apply the computerised HIS program recommendations to my own work	.289
	The computerised HIS provides the precise information I need	.574
	The computerised HIS provides reports that seem to be almost exactly what I need	.668
	The computerised HIS provides sufficient information	.627
	The computerised HIS provides clear output information	.649
	The computerised HIS program is integrated into the work	.475
	The information I access from the computerised HIS program makes my work easier	.600
	I am satisfied with the computerised HIS installed in our department	.642
	The computerised HIS makes the performance of my	.669

Factor	Item	Loading
	department's work easy	
	The computerised HIS improves the quality of our department's work	.612
	The installed computerised HIS in my department was successful	.712
2 Functional factor (usability)	The computerised HIS is accurate	.491
	The health information program improves the quality of work	.579
	The Health Informatics Department personnel are cooperative	.572
	The computerised HIS makes my work easier	.424
3 Managerial factor (technical requirements)	The suggestions I make about the computerised HIS are taken into account	.453
	I have access to the information when I need it	.478
	The number of computers is adequate	.565
	I help other health staff use the computerised HIS in practice	.430
4 Technical factor (evidence-based practice)	I use the computerised HIS to guide my practice	.473
	The computerised HIS' information is always updated	.505
5 Legal factor (policy)	There are general polices for hospitals to have expert personnel in ICT departments	.397
	There are legal penalties for healthcare professionals who do not use the computerised HIS correctly	.532
	There are specific polices for how healthcare professionals should use the computerised HIS	.466
6 Cultural factor (access)	I am unable to use the computerised HIS in my work	.567
	I do not use the computerised HIS in my day-to-day practice	.497

Internal consistency concerns the reliability of the test components, measures consistency within the instrument and questions how well a set of items measures a particular behaviour or characteristic within the test. For a test to be internally consistent, estimates of reliability are based on the average inter-correlations among all items within a test (Cortina, 1993).

The most popular method of testing for internal consistency in the behavioural sciences is by alpha coefficient. After the factor analysis, the internal consistencies of the

revised factors were calculated. These were organisational (acceptability) (α =.908), functional (usability) (α =.815), managerial (technical requirements) (α=.460), functional (evidence-based practice) (α=.706), legal (policy) (α =.721) and technical (access) (α =.699). The coefficient alpha for all factors is .895. These results indicate that the research instrument (survey) was reliable. The data entry was checked by the supervisor and co-adviser.

The issue of validity in qualitative research and data analysis has been explained by Lincoln and Guba (1985). They propose four criteria—credibility, transferability, dependability and confirmability—to serve as a guide to establishing rigour and trustworthiness in qualitative research and data analysis.

The four criteria and how they were embedded in this study are explained below. Credibility transpired during the entire process of the qualitative study (Lincoln & Guba, 1985). Transferability involves the ability for detailed information on the study to be replicated and applied in other contexts. Dependability is used to establish trustworthiness, and entails the ability of peer and 'self' to critically assess or audit the entire research process. Confirmability establishes the objectivity and neutrality of the whole research process, especially regarding the interpretation and conclusions drawn from the research (Lincoln & Guba, 1985; Savin-Baden et al., 2013; Seale, 1999). To establish the confirmability of this study, the conclusions drawn were based solely on the data gathered, and these conclusions were examined in relation to other similar empirical studies, in order to put them in perspective. Reflections on the limitations of the study and its outcome are described in Chapter Six.

Although the four criteria suggested by Lincoln and Guba (1985) were espoused exhaustively, they were not applied rigidly. As can be deduced from the discussion above, this is because consideration was given to the constraints and practicality of the research

process, as well as what procedures worked best, with due cognisance of the research setting. Nonetheless, the processes and procedures applied were robust enough to surmise that the study was conducted in a reasonably valid and trustworthy manner.

3.9 Data Analysis

3.9.1 Quantitative analysis.

Data analysis was conducted using the IBM SPSS version 22, to describe and explore the data and detect the factors affecting positively or negatively on the development and implementation of computerised HIS in Jordanian hospitals, through the calculation of means for all factors and sub-factors, and to identify correlations between participants. The distribution analysis of means and standard deviations (SD) was used to detect the factors affecting the implementation process, and the same was used to detect the benefits of, and barriers to, implementation. T-tests were used for the research questions regarding the six major factors (organisation, managerial, functional, technical, cultural and legal) with gender. After that, ANOVAs were used to detect group correlations between the sub-factors of each major factor and demographic data. The significance level was set at $p < 0.05$ (Levesque, 2007). In all cases a higher score indicated agreement. Where item responses were presented in such a way that a lower score may indicate agreement, scoring was reversed for analytical purposes.

3.9.2 Qualitative (thematic) analysis.

Thematic analysis was used with all qualitative data, and involved identifying themes from the semi-structured interview transcripts. Thematic analysis is a qualitative data analysis method used to identify, analyse and report patterns and/or themes by minimising and describing data in rich detail (Braun & Clarke, 2006). Thematic analysis can also involve the creation and application of ‘codes’ to data in the process of analysis (Lewins & Silver, 2007).

The semi-structured interviews were first transcribed verbatim, and served as the basis for coding, subsequent categorisation and thematic identification. According to Miles and Huberman (1994), 'coding' is the creation of categories with regards to data; the grouping together of different instances of data under an umbrella that enable them to be regarded as 'of the same type'. Further, codes are 'tags or labels for assigning units of meaning to descriptive or inferential information compiled during a study' (Miles & Huberman, 1994, p. 56). Additionally, coding has also been construed as a process whereby segments of data are identified as relating to, or being an example of, a more general idea, instance or theme (Lewins & Silver, 2007), and regarded as integral parts of the analytic process, but not analysis in itself. A distinction is often made between 'open coding' and 'relational or axial coding'. Open coding entails the creation of categories, while relational or axial coding entails relating the open coding categories to each other to examine relationships and meanings (Miles & Huberman, 1994). In this study, both coding methods were employed by first identifying codes and then relating them, to thoroughly code and categorise the data.

The data was read several times, in order to become familiar with its contents and with its range and diversity, and to gain an overview of the body of data gathered (Ritchie & Spencer, 1994). Accordingly, the transcribed data was read through closely before uploading into Maximum Qualitative Data Analysis (MAX QDA 10) software to facilitate thematic coding. The coding process started with deductive or 'selective' coding, where the variables of interest are coded *a priori* and identified across the data (Lewins & Silver, 2007). Therefore, the variables 'organisational factor', 'managerial factor', 'technical factor', 'functional factor', 'cultural factor' and 'legal factor' were selectively coded at the beginning as core codes. This was followed by open coding (inductively), which involved creating sub-codes from the identified *a priori* variables.

Open coding continued until ‘saturation’ was achieved. Saturation, as construed in this study, was the point at which no new properties, dimensions, interactions or consequences could be identified during the process of coding, as per the purpose of the study.

Braun and Clarke (2006, p. 82) assert that ‘a theme captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set’. In qualitative analysis there are no stringent rules over what proportion of a data set needs to display evidence of the theme for it to be considered a theme (Braun & Clarke, 2006), indicating that judgement is essential when determining what constitutes a theme, as a range of factors affect the determination of such. This includes the purpose of the research, time pressure, working individually or in a team, methodology, analytic approach and amount and type of data collected (Lewins & Silver, 2007). All of these factors were considered in this study during the analysis process, with some level of subjectivity and flexibility.

In the process of analysis, certain techniques were used to identified themes and codes that included word repetition, metaphors, analogies, key-words in context and connectors (Ryan & Bernard, 2003). This was guided by Lewins and Silver’s (2007) assertion that the development of codes may be influenced by the research aims; methodology and analytic approach; amount, kinds and sources of data; level and depth of analysis; and constraints. While coding, memos were also made by noting down important information in the data, such as linkages that might not necessarily be ‘codable’ but were useful for theme identification and data interpretation. Identification of theme was applied with due cognisance of the purpose of this study and rationale for employing a qualitative strategy to explore the interrelationships of all factors, from the subjective perspectives of participants.

The final process of analysis involved the use of rational coding to recreate codes into common themes across the data. This was particularly challenging as the researcher is a novice thematic analyst and qualitative researcher. Nonetheless, the use of rational coding explored the interrelationships among the four investigated variables, and other sub-codes identified through the use of open coding. This procedure was repeated in order to confirm the common themes discovered. Initial themes were identified through reading, and were later collapsed to form patterns across the data (Ryan & Bernard, 2003). In Chapter 4, a descriptive method (Ryan & Bernard, 2003) and summary description followed by illustrative quotes from the respondents was used to present the results. In Chapter 6, an interpretative method (Ryan & Bernard, 2003), summary description and illustrative quotes and interpretation are presented.

As stated earlier, semi-structured interviews were conducted with an interview guide derived from relevant key questions from the survey. A reasonable attempt was made to ensure that the interview questions encapsulated the central themes of the scale and subscale of the survey used in the quantitative data collection. The semi-structured interviews explored the role, meaning, interrelationship factors, development and implementation of computerised HIS in hospitals. In addition to the initial semi-structured questions, probing (follow-up) questions were asked to examine each question until saturation was achieved, or similar accounts occurred. See Appendix B for the interview schedule used to guide the semi-structured interviews.

3.10 Ethical Considerations and Procedures

Reasonable and practical measures were instituted to uphold general principles and ethical standards in the conduct of the research. Principles such as beneficence, voluntary participation, informed consent, confidentiality, anonymity and risk of harm were adhered to, in accordance with the guidelines of the American Psychological

Association (APA, 2002). Hospital administrators interested and willing to participate in the research gave permission and approval for the study to be conducted in their hospitals. The purpose and objectives, as well as rationale and significance of the study, were made clear to all participants and participating hospital authorities. For example, information was initially explained to the head of department in hospitals, who explained the purpose of the study to staff.

Ethical approval to conduct the study was received from the University Human Research Ethics Committee (HREC). Informed consent to participate in the study was sought from all participants, who were initially given an information sheet describing the purpose of the study. This also contained an assurance of confidentiality and anonymity. Participants were informed of their right to leave the study at any stage in the research process. Ethical approval was also obtained from the MOH in Jordan prior to data collection (See Appendix C). Participants were also encouraged to ask any questions in relation to the survey and the specific questions asked of them during the semi-structured interviews. Participants were informed that they did not have to answer any questions that made them feel uncomfortable, especially if it related to their privacy. As a way of ensuring the confidentiality of participants, the collected data was entered into SPSS, or the qualitative data management tool, using a safeguarded coding system, and all copies of the consent forms were stored in a safe cabinet, locked with key.

No participant became distressed or was perceived to be at risk during the data collection, and none chose to withdraw from the study during the course of the interviews or survey completion. If any participant was to become vulnerable or feel distressed in the course of the study, a nurse or hospital counsellor would be invited to assist in the resolution of the situation. However, such assistance was not required.

3.11 Summary

This chapter presented an overview of the research methodology, the Taylorism theoretical approach and the stratified, cross-sectional, exploratory, sequential mixed-method design. The population of this study was Jordanian health staff, and the sample was 540 participants from four hospitals covering all hospital sectors in Jordan. In the qualitative section, the sample size was 16 interviews, with staff expert at using computerised HIS in Jordan. The alpha coefficients for all factors was (a = .895), meaning that the research instrument (survey) was reliable. The quantitative data was analysed using the SPSS program, and the qualitative data by thematic analysis. Finally, the ethical considerations of the study were addressed. The next chapter provides the results of the qualitative and quantitative data.

Chapter 4: Quantitative results

4.1 Introduction

The previous chapter presented the research methodology and analysis techniques applied to investigate the study's research questions. As this was a mixed-methods design, this chapter presents the quantitative findings, followed by the qualitative findings in Chapter 5. These are presented in line with the five research questions:

1. What are the factors promoting the development and implementation of computerised HISs in Jordan?
2. What are the factors hindering the development of computerised HISs in Jordan?
3. What are the benefits of developing and implementing computerised HISs in Jordan?
4. What are the barriers to implementing computerised HISs in Jordan?
5. What effect do participants' backgrounds have on their responses to the questionnaire on factors promoting or hindering the development and implementation of computerised HIS in Jordan?

4.2 Demographic Characteristics

All demographic data is presented in Table 4.1. A total of 540 responses were received, with none rejected due to missing data. The final response rate was 83 per cent. While differences emerged in most demographic data, all were within the expected ratios of the hospitals under study. Table 4.1 summarises the demographic profile of the respondents by hospital.

Table 4.1

Demographic profiles of each hospital included in the study

	HH		RMS		JH		KAUH		All	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Gender										
male	71	(52.59)	73	(54.07)	73	(54.07)	67	(49.63)	284	(52.6)
female	64	(47.41)	62	(45.93)	62	(45.93)	68	(50.37)	256	(47.4)
Occupation										
Manager	12	(8.89)	13	(9.63)	10	(7.41)	18	(13.33)	53	(9.8)
Physician	19	(14.07)	22	(16.30)	14	(10.37)	19	(14.07)	74	(13.7)
Nurse	72	(53.33)	65	(48.15)	71	(52.59)	61	(45.19)	269	(49.8)
Other health staff	32	(23.70)	35	(25.93)	40	(29.63)	37	(27.41)	144	(26.7)
Age (years)										
25 to 29	58	(42.96)	56	(41.48)	61	(45.19)	53	(39.26)	228	(42.2)
30 to 39	51	(37.78)	45	(33.33)	47	(34.81)	56	(41.48)	199	(36.9)
40 to 49	23	(17.04)	31	(22.96)	23	(17.04)	23	(17.04)	100	(18.5)
50+	3	(2.22)	3	(2.22)	4	(2.96)	3	(2.22)	13	(2.4)
Education level										
Diploma	9	(6.67)	11	(8.15)	19	(14.07)	6	(4.44)	45	(8.3)
Bachelor’s	117	(86.67)	119	(88.15)	106	(78.52)	119	(88.15)	461	(85.4)
Postgraduate	9	(6.67)	5	(3.70)	10	(7.41)	10	(7.41)	34	(6.3)
Department										

	HH		RMS		JH		KAUH		All	
Emergency	8	(5.93)	6	(4.44)	3	(2.22)	4	(2.96)	21	(3.9)
Medical	58	(42.96)	60	(44.44)	77	(57.04)	62	(45.93)	257	(47.6)
Medical R.	8	(5.93)	16	(11.85)	10	(7.41)	13	(9.63)	47	(8.7)
Surgical	33	(24.44)	23	(17.04)	11	(8.15)	22	(16.30)	89	(16.5)
Accounting	5	(3.70)	8	(5.93)	8	(5.93)	10	(7.41)	31	(5.7)
Laboratory	10	(7.41)	6	(4.44)	11	(8.15)	11	(8.15)	38	(7.0)
Radiology	7	(5.19)	5	(3.70)	7	(5.19)	4	(2.96)	23	(4.3)
Pharmacy	6	(4.44)	11	(8.15)	8	(5.93)	9	(6.67)	34	(6.3)
Experience (years)										
3 to 5	57	(42.22)	52	(38.52)	51	(37.78)	44	(32.59)	204	(37.8)
6 to 10	36	(26.67)	32	(23.70)	35	(25.93)	43	(31.85)	146	(27.0)
11 to 15	21	(15.56)	19	(14.07)	24	(17.78)	26	(19.26)	90	(16.7)
16+	21	(15.56)	32	(23.70)	25	(18.52)	22	(16.30)	100	(18.5)

4.3 Descriptive Statistics

This section summarises the six factors identified in the survey. Each research question is addressed separately.

- Q1&2: What are the factors promoting the development and implementation or hindering the development of computerised HISs in Jordan?

The following section summarises the results of the above research questions, and the analyses are presented below for all respondents combined, across hospitals. Overall, participants agreed with all factors. They disagreed with the cultural factor, as this was negatively stated in the survey. Therefore, the items contained within this factor were reversed, in order to provide consistency in the analysis.

Table 4.2

Factors promoting the development and implementation or hindering the development of computerised HISs in Jordanian hospitals

	M	(SD)
Organisational	4.02	(0.44)
Functional	4.15	(0.59)
Managerial	3.62	(0.64)
Technical	3.59	(0.74)
Legal	3.85	(0.60)
Cultural*	4.16	(0.65)

Note: N = 540; * item scores reversed

The means and SD across all items within the factors were checked for outliers. No such occurrences were found. The ranges in the items' score were: organisational 1.83 to 5.00; functional 2.00 to 5.00; managerial 1.25 to 5.00; technical 1.50 to 5.00; cultural 1.50 to 5.00; legal 2.00 to 5.00.

A number of significant correlations were observed (Table 4.3). The six factors were strongly positively correlated. With the exception of the cultural and technical factors, all other factors were significantly positively correlated with one another.

Table 4.3

Correlations for the survey total score mean and all factors

	Total	Organisational	Functional	Managerial	Technical	Legal	Cultural
Organisational	.78**	1					
Functional	.72**	.56**	1				
Managerial	.67**	.57**	.46**	1			
Technical	.55**	.24**	.27**	.20**	1		
Legal	.54**	.38**	.19**	.20**	.15**	1	
Cultural	.50**	.33**	.26**	.13**	.01	.14**	

Note: **p < 01

4.4 Benefits of Computerised HIS

This section summarises the results of research questions three.

- Q3: What are the benefits of developing and implementing computerised HIS in Jordan?

To answer these questions, descriptive statistics were used, followed by univariate testing (ANOVA). The results of the analysis are presented below. Benefits are grouped into two categories: clinical and organisational. These categories were derived from the current literature, as well as from analysis of the data. A principal components factor analysis with a Varimax rotation confirmed these two categories. Item one of the organisational benefit category could be included in the clinical category, as it may be construed either way. A decision was made to leave it in the organisation category (see Appendix A, Section G tables). ‘Clinical’ refers to items that relate to direct patient contact that affects the work of healthcare professionals. ‘Organisational’ include work

structures and procedures. The following sections summarise the benefits and barriers for each category.

4.4.1 The benefits: Clinical issues.

This category focuses on delays in development or implementation, rather than on improving health conditions. Information reported was related to improving healthcare processes in Jordanian hospitals (Table 4.4). Overall, healthcare workers considered the direct clinical benefits of computerised HIS to be good. The range of scores across all items was 3.93 to 4.32.

Table 4.4

Mean and SD of the benefits: Clinical issues

No.	Items	M	(SD)
Clinical total		4.13	(0.52)
1.	The computerised HIS facilitates patients care	4.32	(0.63)
2.	The computerised HIS facilitates decision-making on patient care	4.25	(0.61)
3.	The computerised HIS ensures coordination of patient care	4.04	(0.69)
4.	I use the computerised HIS to enter daily notes, order clinical biochemical laboratory analyses and obtain information on investigation or treatment procedures	4.00	(0.72)
5.	I use the computerised HIS to answer questions on general medical knowledge (e.g., treatment, symptoms, complications)	3.93	(0.74)

4.4.2 The benefits: Organisational category.

This category focuses on improving the health condition of patients. Improving healthcare processes in Jordanian hospitals is important for improving the health of the Jordanian population (Table 4.5). The results show that most healthcare workers consider the organisational benefits to be high, and positively endorse all items. The range of scores across all items was 3.94 to 4.26.

Table 4.5

Mean and SD of the benefits: Organisational issues

No.	Items	M	(SD)
Organisational total		3.98	(0.51)
1.	The computerised HIS ensures continuity of patient care	4.26	(0.61)
2.	The computerised HIS facilitates communication between healthcare teams in hospital departments	4.07	(0.64)
3.	I use the computerised HIS as it gives high quality information	3.97	(0.77)
4.	The computerised HIS achieves individualised care	3.96	(0.88)
5.	The computerised HIS improves research development	3.94	(0.69)
6.	I use the computerised HIS to review patient problems, and to give written general medical information to patients	3.99	(0.66)
7.	I use the computerised HIS to enter daily notes, order clinical biochemical laboratory analyses and obtain information on investigation or treatment procedures	4.00	(0.72)

4.4.3 Between-group comparisons of the benefits of computerised HIS.

Table 4.6 provides the one-way ANOVA for the benefits (clinical and organisational). A number of significant differences are evident. When using a combined benefits score of the 12 items, significant differences were found with job type ($F [3, 539] = 5.53$, $p < .01$), age ($F [3, 539] = 15.94$, $p < .001$) and work experience ($F [3, 539] = 16.14$, $p < .001$). Overall, nurses in the 25 to 29 age group with fewer years' experience accounted for these differences (Generalised Linear Model: $F [31, 539] = 1.82$, $p < .05$). This group endorsed the overall benefits less than the other professions.

Table4.6

Multiple group comparisons between benefits (clinical and organisational) and demographics

		Benefits					
		Clinical			Organisational		
	N	M	(SD)	ANOVA	M	(SD)	ANOVA
Gender							
male	284	4.13	(.49)	F(1, 539) =.001, *p >.05*	3.97	(.49)	*F(1, 539) =.078, p >.05*
female	256	4.13	(.55)		3.98	(.55)	
Job type							
Manager	53	4.20	(.52)	F(3, 539) = 6.23, *p <.001*	4.09	(.58)	*F(3, 539) = 4.94, p <.01*
Physician	74	4.22	(.46)		4.15	(.49)	
Nurse	269	4.04*	(.54)		3.92*	(.51)	
Other health staff	144	4.24	(.48)		3.95	(.49)	
Age (years)							
25 to 29	228*	4.04	(.55)	F(3, 539) = 6.57, *p <.001*	3.88	(.46)	*F(3, 539) = 18.88, p <.001*
30 to 39	199	4.16	(.49)		3.92	(.49)	
40 to 49	100	4.31	(.47)		4.31*	(.55)	
50+	13	4.02	(.46)		3.91	(.45)	
Education level							
Diploma	45	4.16	(.64)	F(2, 539) =.53, *p >.05*	3.84	(.49)	*F(2, 539) = 1.91, p >.05*
Bachelor's	461	4.12	(.51)		3.99	(.52)	
Postgraduate	34	4.21	(.45)		3.92	(.42)	
Department							

		Benefits					
		Clinical			Organisational		
	N	M	(SD)	ANOVA	M	(SD)	ANOVA
Emergency	21*	3.89	(.70)		3.90	(.45)	
Medical	257	4.08	(.50)		3.96	(.55)	
Medical records	47	4.38	(.43)		4.09	(.48)	
Surgical	89	4.04	(.60)	F(7, 539) = 4.49, *p <.001*	3.97	(.51)	*F(7, 539) =.99, p >.05*
Accounting	31	4.37	(.36)		3.90	(.43)	
Laboratory	38	4.23	(.46)		3.88	(.41)	
Radiology	23	4.23	(.43)		4.06	(.52)	
Pharmacy	34	4.21	(.52)		4.09	(.52)	
Work experience (years)							
3 to 5	204*	4.03	(.53)		3.89	(.44)	
6 to 10	146	4.11	(.51)	F(3, 539) = 8.14, *p <.001*	3.87	(.52)	*F(3, 539) = 16.75, p<.001*
11 to 15	90	4.18	(.50)		4.02	(.51)	
16 +	100	4.33	(.46)		4.27*	(.54)	

Note: * Tukey *post hoc* analysis p < .05

4.5 Effect of Demographic Variables on Survey Responses

In answering the research questions it was important to understand the influence of the different groups represented in the hospitals in which HISs were being implemented. Therefore analyses was performed to answer question five: what effect do participants' backgrounds have on their responses to the questionnaire on factors promoting or hindering the development and implementation of computerised HIS in Jordan? Initial descriptive tests were performed, followed by one-way ANOVAs.

4.6 Gender Comparisons Between Factors

Table 4.7 provides the means, SD and t-test results related to gender. There was no difference between gender and the survey's total average mean. However, when considering the individual factors, a difference emerged for the organisational factor (t [537] = 2.32, $p < .05$). Males positively endorsed this factor more than females. No significant differences were found in any of the remaining factors.

Table 4.7

Means, SD and t-test scores for gender and survey's total score mean

	N	M	(SD)	*t*	*p*
Gender					
male	283	3.92	(0.36)	1.39	*0.17*
female	256	3.87	(0.37)		

4.7 Occupation Comparisons Between the Total Score Mean

Table 4.8 provides the mean and SD for healthcare workers' occupations, and the survey total mean score. Nurses are significantly different from members of other professions, in that they endorsed the overall implementation of HIS less, as observed in previous studies (Carmine & Daniel, 2007; Mair et al., 2012).

Table 4.8

Means and SD based on occupation and survey's total score mean

	N	M	(SD)	ANOVA
Profession				
Manager, department manager	53	3.96	(0.20)	*F(3, 538) = 9.44, p <.001*
Physician	73	3.97	(0.27)	
Nurse*	269	3.81	(0.27)	
Other health staff	144	4.00	(0.28)	

Note: *Tukey HSD *post hoc* analysis identified a significant difference between nurses and other health staff p < 05

4.7.1 Group comparisons between occupation and each factor.

Table 4.9 provides one-way ANOVA results for the occupation of the healthcare workers. There are significant differences between occupation and the organisational, functional and managerial factors. In all cases, nurses scored lower than other professions.

Table 4.9

One-way ANOVA for occupation and the six factors

	N	M	(SD)	ANOVA
Organisational				
Manager	53	4.05	(0.33)	
Physician	73	4.14	(0.38)	*F(3, 539) = 10.16, p <.001*
Nurse*	269	3.93	(0.46)	
Other health staff	144	4.14	(0.40)	
Functional				
Manager	53	4.05	(0.33)	
Physician	74	4.14	(0.38)	*F(3, 539) = 8.67, p <.001*
Nurse*	269	3.93	(0.46)	
Other health staff	144	4.14	(0.40)	
Managerial				
Manager	53	3.60	(0.60)	
Physician	74	3.75	(0.60)	*F(3, 539) = 8.36, p <.001*
Nurse*	269	3.50	(0.66)	
Other health staff	144	3.79	(0.58)	

Note: * Tukey HSD significant difference in this group, p < 05

Table 4.9 (continued)

One-way ANOVA for occupation and the six factors

	N	M	(SD)	ANOVA
Technical				
Manager	53	3.73	(0.68)	*F(3, 539) = 1.46, p >.05*
Physician	74	3.49	(0.78)	
Nurse	269	3.56	(0.69)	
Other health staff	144	3.64	(0.83)	
Legal				
Manager	53	3.80	(0.43)	*F(3, 539) = 2.23, p >.05*
Physician	74	3.87	(0.61)	
Nurse	269	3.80	(0.62)	
Other health staff	144	3.96	(0.59)	
Cultural				
Manager	53	4.25	(0.61)	*F(3, 539) = 2.40, p >.05*
Physician	74	4.24	(0.61)	
Nurse	269	4.08	(0.65)	
Other health staff	144	4.22	(0.69)	

Note: * Tukey HSD significant difference in this group, p < 05

4.8 Age Comparisons Between Survey Total Score Mean

Table 4.10 provides the mean and SD among the age of healthcare workers in Jordanian hospitals that have implemented computerised HIS. No significant differences were noted between the total score and age.

Table 4.10

Means and SD based on age and the survey's total score mean

	N	M	(SD)	ANOVA
Age (years)				
25 to 29	228	3.58	(.29)	*F(3, 538) =.77, p >.05*
30 to 39	198	3.59	(.26)	
40 to 49	100	3.66	(.21)	
50+	13	3.59	(.31)	

When breaking this down by individual factors, significant differences emerged for age group and four of the factors (Table 4.11). There were significant differences due to age and organisational, functional, managerial and cultural factors. In all cases except the organisational factor, the 40 to 49 age groups differed. However, the direction was not always the same. For the functional and cultural factors, this age group endorsed the factor more positively, while the reverse was true in the managerial factor. The only departure from this finding was that the 25 to 29 age group endorsed organisational factors lower than the 40 to 49 age group, but were not significantly different to the others.

Table 4.11

One-way ANOVA for age group and the six factors

	N	M	(SD)	ANOVA
Organisational				
25 to 29*	228	3.98	(.48)	
30 to 39	199	4.03	(.44)	*F(3, 538) = 2.75, p <.05*
40 to 49	100	4.12	(.32)	
50+	13	4.11	(.33)	
Functional				
25 to 29	228	4.07	(.60)	
30 to 39	199	4.10	(.56)	*F(3, 539) = 11.18, p <.001*
40 to 49*	100	4.45	(.47)	
50+	13	4.23	(.77)	
Managerial				
25 to 29	228	3.65	(.66)	
30 to 39	199	3.72	(.58)	*F(3, 539) = 8.72, p <.001*
40 to 49*	100	3.34	(.63)	
50+	13	3.73	(.66)	
Technical				
25 to 29	228	3.59	(.73)	
30 to 39	199	3.60	(.79)	*F(3, 539) =.65, p >.05*
40 to 49	100	3.56	(.67)	
50+	13	3.62	(.74)	
Legal				
25 to 29	228	3.88	(.63)	
30 to 39	199	3.86	(.61)	*F(3, 539) = 1.28, p >.05*
40 to 49	100	3.82	(.50)	
50+	13	3.56	(.53)	
Cultural				
25 to 29	228	4.10	(.70)	
30 to 39	199	4.09	(.66)	*F(3, 539) = 5.80, p <.01*
40 to 49*	100	4.36	(.49)	
50+	13	4.50	(.46)	

Note: * Tukey HSD *post hoc* analysis, p < 05

4.9 Group Comparisons Between Education Level and the Survey's Total Score Mean

No significant differences were observed for level of education and either the survey's total score mean or any individual factors (Tables 4.12 & 4.13).

Table 4.12

Means and SD based on education level and survey's total score mean

	N	M	(SD)	ANOVA
Education group				
Diploma	45	2.49	(0.97)	
Bachelor's	461	2.49	(1.13)	*F(2, 538) =.41, p >.05*
Postgraduate	34	2.62	(1.18)	

A one-way ANOVA of the level of education and each of the six factors also revealed no significant differences (Table 4.14).

Table 4.13

One-way ANOVA for education level and the six factors

	N	M	(SD)	ANOVA	M	(SD)	ANOVA
			Organisational			Technical	
Diploma	45	4.08	(.40)	*F(2, 538) = 1.01, p >.05*	3.50	(.94)	*F*(2, 539) = 2.00, *p >.05*
Bachelor's	461	4.03	(.43)		3.61	(.71)	
Postgraduate	34	3.94	(.50)		3.38	(.88)	
			Functional			Legal	
Diploma	45	4.21	(.60)	*F(2, 539) = 1.10, p >.05*	4.02	(.56)	*F*(2, 539) = 2.74, *p >.05*
Bachelor's	461	4.16	(.58)		3.83	(.60)	
Postgraduate	34	4.02	(.58)		3.96	(.58)	
			Managerial			Cultural	
Diploma	45	3.77	(.62)	*F(2, 539) = 1.30, p >.05*	4.01	(.68)	*F*(2, 539) = 1.38, *p >.05*
Bachelor's	461	3.61	(.63)		4.16	(.65)	
Postgraduate	34	3.60	(.69)		4.24	(.72)	

4.10 Group Comparisons Between Hospital Departments and the Survey's Total Score Mean

Table 4.14 provides the mean and SD of the hospital departments. There is a difference in the means of hospital departments that implemented computerised HIS. This means that some healthcare workers in different departments agree on the factors that affect implementation of computerised HIS, while other healthcare workers disagree.

Table 4.14

Means and SD based on hospital departments and survey's total score mean

	N	M	(SD)	ANOVA
Department				
Emergency	21	3.71	(0.39)	
Medical	257	3.87	(0.37)	
Medical records	47	3.95	(0.30)	
Surgical	89	3.85	(0.39)	
Accounting*	31	4.14	(0.36)	*F(7, 539) = 3.78, p <.001*
Laboratory	38	3.98	(0.33)	
Radiology	22	3.99	(0.29)	
Pharmacy	34	3.93	(0.41)	

Note: Tukey *post hoc* p < 05

While there was a significant difference for the department worked in and the survey's total score, accounting may not experience some of the day-to-day management issues faced by clinical departments, which could explain their higher endorsement of the survey. Based on an analysis of each of the six factors, a number of significant differences were noted for the organisational, managerial and legal factors. However, a Tukey *post hoc* analysis revealed that accounting was the only significant group, and this was only found in the organisational factor. This may reflect the effect that computerised HIS has on departments, rather than on specific factors affecting individuals' views. The department that endorsed implementation the most was the only non-clinical department.

Table 4.15

One way ANOVA for work departments and the six factors

	N	M	(SD)	ANOVA	M	(SD)	ANOVA
		Organisational			Technical		
Emergency	21	3.42	(1.9)		4.20	(.88)	
Medical	257	4.05	(.81)		3.74	(1.03)	
Medical records	47	3.89	(.82)		3.66	(1.07)	
Surgical	89	3.97	(.80)	*F(7, 539) = 5.94, p <.001*	2.87	(.90)	*F(7, 539) = 1.06, p >.05*
Accounting	31	4.18*	(.65)		3.70	(.84)	
Laboratory	38	4.11	(.64)		3.42	(.75)	
Radiology	23	3.97	(.71)		3.95	(.71)	
Pharmacy	34	3.75	(.85)		3.76	(.80)	
		Functional			Legal		
Emergency	21	3.94	(.72)		4.08	(.72)	
Medical	257	4.16	(.62)		4.09	(.73)	
Medical records	47	4.09	(.66)		4.11	(.72)	
Surgical	89	3.69	(.86)	*F(7, 539) = 1.64, p >.05*	4.07	(.74)	*F(7, 539) = 2.11, p <.05*
Accounting	31	4.16	(.69)		4.20	(.77)	
Laboratory	38	4.24	(.70)		4.21	(.72)	
Radiology	23	4.10	(.66)		4.07	(.89)	
Pharmacy	34	4.08	(.76)		4.15	(1.03)	
		Managerial			Cultural		
Emergency	257	4.09	(.71)		3.74	(.91)	
Medical	47	4.07	(.80)		3.67	(.84)	
Medical records	89	3.99	(.71)		2.87	(.75)	
Surgical	31	4.08	(.70)	*F(7, 539) = 3.61, p <.001*	3.70	(.75)	*F(7, 539) = 1.53, p >.05*
Accounting	38	4.07	(.72)		3.47	(.71)	
Laboratory	23	4.10	(.73)		3.95	(.73)	
Radiology	34	4.12	(.72)		3.76	(.76)	
Pharmacy	21	4.05	(.74)		3.84	(.72)	

Note: * Tukey HSD *post hoc* analysis p < 05

4.11 Group Comparisons Between Work Experience of Staff and Survey's Total Score Mean

Table 4.16 provides the mean and SD of the experience level of healthcare workers, and the survey's total score mean. The results indicate that there is a significant difference in mean score and level of experience. This was attributable to the more experienced 16+ years of experience group.

Table 4.16

Mean, SD and ANOVA based on work experience and survey's total score mean

	N	M	(SD)	ANOVA
Experience (year)				
3 to 5	204	3.87	(.41)	
6 to 10	146	3.88	(.35)	*F(3, 538) = 3.32, p <.05*
11 to 15	90	3.93	(.37)	
16+	100	3.96*	(.29)	

Note: *Tukey *post hoc* analysis p <.05

Table 4.17 provides one-way ANOVA results for the work experience of healthcare workers. Significant differences were found on the organisational, functional, managerial and cultural factors. In all cases, Tukey *post hoc* analysis reveals the more experienced group (16+ years) to be different from at least one—and in most cases all—other experience levels. With the exception of the managerial factor, the 16+ years group was more likely to positively endorse the factor.

Table 4.17

One-way ANOVA for work experience and the six factors

	N	M	(SD)	ANOVA
Organisational (years)				
3 to 5	204	3.98	(.48)	
6 to 10	146	3.97	(.42)	*F(3,538) = 5.53, p <.01*
11 to 15	90	4.06	(.46)	
16+	100	4.17*	(.28)	
Functional (years)				
3 to 5	204	4.04	(.61)	
6 to 10	146	4.12	(.60)	*F(3,539) = 11.38, p <.001*
11 to 15	90	4.16	(.47)	
16+	100	4.44*	(.51)	
Managerial (years)				
3 to 5	204	3.65	(.68)	
6 to 10	146	3.73	(.62)	*F(3, 539) = 8.10, p <.001*
11 to 15	90	3.69	(.46)	
16+	100	3.35*	(.65)	
Technical (years)				
3 to 5	204	3.60	(.74)	
6 to 10	146	3.55	(.74)	F(3, 539) = 1.12, *p >.05*
11 to 15	90	3.61	(.88)	
16+	100	3.62	(.61)	
Legal (years)				
3 to 5	204	3.88	(.63)	
6 to 10	146	3.8	(.59)	*F(3, 539) = 2.08, p >.05*
11 to 15	90	3.97	(.60)	
16+	100	3.78	(.54)	
Cultural (years)				
3 to 5	204	4.08	(.67)	
6 to 10	146	4.12	(.66)	*F(3,539) =6.53, p <.001*
11 to 15	90	4.09	(.71)	
16+	100	4.41*	(.48)	

Note: *Tukey HSD *post hoc* analysis p < 05

4.12 Summary of Quantitative Results

The study analysis summarises the six factors promoting or hindering the development and implementation of computerised HIS in Jordan. The first is the organisational factor or acceptability, which contains 23 sub-factors. All sub-factors had a positive effect on implementation processes. The second is the functional or usability factor, which contains four sub-functional factors. The third is the managerial or technical requirements factor, which contains four sub-managerial factors. All sub-factors had a positive effect on the implementation processes of computerised HIS. The fourth factor, technical or evidence-based practice, contains two sub-technical factors. These sub-factors had a positive effect on the implementation processes of computerised HIS. The fifth factor, legal, contains three sub-legal factors. All sub-factors had a positive effect on the implementation processes of computerised HIS. The cultural factor contains two sub-factors, which had a positive effect on the implementation processes of computerised HIS.

The study analysis summarises the benefits of the use of the computerised HIS in Jordanian hospitals, and are grouped into two categories: clinical and organisational. These categories were derived from the current literature, as well as from the data analysis. There were five clinical and seven organisational benefits of the study.

Chapter 5: Qualitative Results

5.1 Introduction

The researcher conducted 16 semi-structured interviews in four hospitals, with each hospital representing one of the four Jordanian hospital sectors. The interviews were with hospital and department managers and staff in the administration, nursing, laboratory, pharmacy, radiology and quality departments, as well as the computerised HIS and medical records manager. The interviews were between 30 minutes and one hour in duration. The participants' positions are referred to, but their names or the hospital with which they are associated are not mentioned, in order to protect their identity and maintain confidentiality. Direct quotations have been used to give a voice to the participants and provide readers with perspectives on participants' lived experiences.

The qualitative component of this study used the methodological principle of thematic analysis. This was considered an appropriate method for this study because there is little information on the factors affecting the implementation of computerised HIS, and this study was devised to uncover them (Wilkinson, 2004). Thematic analysis of the data began during the data collection period, when the content was fresh in the researcher's mind, and continued until themes emerged. The interviews were in Arabic, so the researcher translated them into English throughout the interview process.

The study themes were identified using a summarised explicatory approach to the data, as described by Wojnar and Swanson (2007). The process of identifying the themes included reading the interviews to obtain a general understanding; coding for emerging themes in the implementation of computerised HIS; identifying common themes from the themed transcripts; explaining agreements and disagreements in the interpretation; identifying common themes and patterns, and making inferences from them; and selecting sample quotes to clarify themes that appeared.

The major question and a general idea of the study were provided to the participants. Discussion then progressed to more specific questions. The participants were asked the following ten questions, to detect the major factors promoting or hindering the development and implementation of computerised HIS in Jordan:

1. What are the problems related to data collection, report preparation and information flows from health facilities to higher levels?
2. What are the factors promoting the development and implementation of a computerised HIS in hospitals?
3. How is patient healthcare data being collected?
4. What tools are used to collect and store (record) collected data?
5. How is healthcare data kept and managed over time?
6. Where is the collected data sent?
7. Which of the collected data is used?
8. Who uses the data, and for what purpose?
9. How is patient information shared?
10. What are the barriers to the development and implementation of a computerised HIS system in the hospital?

The researcher used manual methods of organising and analysing the qualitative data, because the amount of data collected was relatively small and the category system was relatively simple (Polit & Beck, 2012).

The next section will illustrate the process of analysing the semi-structured interview questions, to explain the five themes and sub-themes that emerged from the study participant.

5.2 Demographic Data

The researcher felt that it was important to gather demographic data, in order to strengthen the claim that respondents were expert managers and department managers of the four hospitals. According to Benner (1984), experts are recognised by groups, and in this case, the groups were the four executive managers and department managers from each hospital sector in Jordan. Also, expert managers and department managers have extensive clinical experience with the implementation of computerised HIS in Jordanian hospitals, so it was important for the researcher to identify the qualifications and employment history of the respondents. The collected demographic data identified the number of years the respondents had been at the hospital. The identified expert managers were aware of changes resulting from the implementation of computerised HIS, as well as of the improved quality of healthcare in some hospitals after implementation. Other details gathered included age, education level and length of participants' work experience in the hospitals. This data was used to complement the interview analysis.

In Table 5.1, the demographic profile is provided for the participants and selected managers and heads of hospital departments. The computerised HIS was perceived as a positive change by all participants. Participants' education levels ranged from a Bachelor's degree to a PhD, with most having a Bachelor's degree. Their length of experience ranged from 15 to 37 years.

Table 5.1

Participants' demographic profiles

	Participants	Age	Work experience (years)	Education level	Awareness of computerised HIS change (positive or negative)
1.	Manager of MR	52	25	Bachelor's	Positive
2.	Technical manager (1)	56	31	PhD	Positive
3.	Manager of quality department	41	15	Master's	Positive
4.	Head of nursing department (1)	58	34	PhD	Positive
5.	Managerial manager (1)	63	36	Bachelor of Medicine	Positive
6.	Manager of pharmacy	49	26	Bachelor's	Positive
7.	Manager of laboratories department (1)	50	27	Bachelor's	Positive
8.	Head of nursing department (2)	54	32	Master's	Positive
9.	General manager	61	34	Bachelor of Medicine	Positive
10.	Manager of radiology department	57	31	Bachelor's	Positive
11.	Manager of laboratories department (2)	50	27	Bachelor's	Positive
12.	Head of IT department (1)	47	24	Master's	Positive
13.	Technical manager (2)	55	29	Bachelor of Medicine	Positive
14.	Managerial manager (2)	66	37	Bachelor of Medicine	Positive
15.	Head of nursing department (3)	49	25	Bachelor's	Positive
16.	Head of IT department (2)	51	27	Bachelor of Medicine	Positive

The following themes emerged from participants' views on the major factors promoting or hindering the development and implementation of computerised HIS in Jordan. These were collected under five themes, each of which contains sub-themes:

- Theme 1: Organisational factor:

  Sub-theme 1: Improvement of healthcare quality.

  Sub-theme 2: Accurate and comprehensive health information.

  Sub-theme 3: Effects of computerised HIS on professional healthcare staff.

  Sub-theme 4: The policies of a computerised HIS.

- Theme 2: Managerial factor:

  Sub-theme 1: The process of accessing information through computerised HIS.

  Sub-theme 2: The training and cooperation between healthcare workers in using computerised HIS.

  Sub-theme 3: The reliability of health information data in using computerised HIS.

  Sub-theme 4: The satisfaction of healthcare workers in using computerised HIS.

- Theme 3: Functional and technical factor:

  Sub-theme 1: The uses of computerised HIS.

  Sub-theme 2: The decision-making process.

  Sub-theme 3: The merging of computerised HIS with healthcare workers' work.

  Sub-theme 4: The updating processes of computerised HIS.

- Theme 4: Benefits of computerised HIS:

  Sub-theme 1: Improvement of healthcare quality for patients.

  Sub-theme 2: Enhanced decision-making processes for patient care.

Sub-theme 3: Enhanced cooperation and contact process between healthcare workers.

Sub-theme 4: Patient security.

Sub-theme 5: Improvement and development of scientific health research process.

- Theme 5: Barriers to computerised HIS implementation:

Sub-theme 1: Updating process of computerised HIS.

Sub-theme 2: Shortage of equipment for computerised HIS.

Sub-theme 3: Resistance to implementation of computerised HIS.

5.3 Theme 1: Organisational Factor

The first theme is the organisational factor, which contains four sub-themes: perceptions of how computerised HIS improves the quality of healthcare; the comprehensiveness and accuracy of health data; the effects of computerised HIS on healthcare staff; and policies related to computerised HIS.

5.3.1 Sub-theme 1: Improvement of healthcare quality.

Participants described the importance of the development and implementation of computerised HIS, which enabled staff to work more easily than before. For example, participant 2, from RMS Hospital, said:

> In the past, the paper file problem was the most important issue to implement the computerised health information system in the department to make the healthcare process easy and also make the work of health staff easy. For example, the information of patients was stored on paper, and these files most of time became lost in the shelves, so when the patient was admitted to hospital on another occasion he needed a new file and a new admission process that included the patient history and all investigations, and these take a long time. But the

> computerised health information system solves this problem, as inserting the patient medical number or the patient name then makes all patient information appear in the system. The old process was time-consuming for patient treatment. So this process has improved the patients' healthcare process.

The participants agreed on the importance of improving the quality of healthcare. Several described how computerised HIS improves communication, eliminating paper and speeding up processes. Participant 5, from HH, said:

> Before using a computerised health information system, in the beginning, during use of patient paper files, we needed more time to get patient information. Now, after applying a computerised health information system, we need less time after applying this system. That means the computerised health information system improves the continuity of the healthcare process for all patients. Another example for improving quality of patient care is that applying computerised health information system consumes the effort of patients when they are coming to the clinic. For example, when he come to a private clinic in the beginning, he goes to medical records to bring his file, and then he comes back to the clinic and waits until the nurse tells him to enter the clinic to see his specialist. This process in general needs at least four hours, and this means suffering for the patients. And sometimes the patient cannot find his file, and he needs to make new file, and this process takes also more time. But after implementing this program, the healthcare process is better than before, because the new system stops consuming time for the patients in clinics or in departments by getting and saving data from electronic patient files. All these things make healthcare workers' work easier.

5.3.2 Sub-theme 2: Accurate and comprehensive health information.

Participants expressed that the development and implementation of computerised HIS enhanced the accuracy and comprehensiveness of health information. Accurate information decreases medical errors. Participant 1, from KAUH, said:

> From the factors that promote implementing computerised health information system in hospital is a decrease in the number of medical error cases for all healthcare workers in all hospital departments, especially for laboratory, pharmacy and medical records. For example, when the doctor write the medication prescription he enters the prescription to the system, then it is gone to pharmacy, the pharmacist receives the prescription electronically, and he prepares to an electronic document this medication for this patients and sends it to the department. This process forces the doctor and the pharmacist to recheck the order and information to be sure about it, because the system identifies who is the person who makes a medical error.

Participants focused on the point saying that computerised HIS are a comprehensive program. They then described how, in general, applying it in Jordanian hospitals makes it easier for healthcare workers to find most information they need, as it relates to patient care processes in all hospital departments. For example, participant 1, from JH, said:

> All hospital departments are contained in this system, including the accounting department; that means the health information system is comprehensive for everything related to the patient from his admission from the clinic or from the emergency department, then to the next department, for example the medical department, so the doctors and the nurses and the other healthcare workers entering the data to the system know when the patient is admitted and discharged

from the hospital. This process included all patient information such as patient history, consultations, medical report, all hospital tests, medications, treatment process, financial matters, and discharge report. Also all this information is kept in the system to use when the patient comes back to hospital or to the clinic.

5.3.3 Sub-theme 3: The effect of computerised HIS on healthcare workers.

This sub-theme was mentioned by the majority of interview participants. They agreed on the positive effect of computerised HIS on their work. Most participants felt that their work became easier after the implementation of the system. For example, participant 1, from HH, said:

> The most effect of implemented computerised health information system in hospitals is easier medical staff work. For example, when the doctor and nurse want to get information about laboratory blood result, he needs to wait until the result comes from the laboratory; then the doctors and nurse start applying the order, and this takes more time from the medical staff, but when the medical staff get the information direct from the system, this helps them to start their work directly, and this is makes their work more easy because they finish it in a short time.

5.3.4 Sub-theme 4: The policies of computerised HIS.

This sub-theme was mentioned by the majority of interview participants. Participants agreed that computerised HIS had a positive effect on their work, and that they ensured fewer medical errors occurred. For example, participant 2, from RMS Hospital, said:

> One of the most important factors that support applying a computerised health information system in hospital is a decrease in medical errors through applying health information system to checking and rechecking the medical information for

> the patients before any medical procedure, also because the employee now can see electronically from this system who is the person who did that procedure. After detecting the employee who made this medical error, there is punishment for this person for this medical error and for each employee who makes medical errors for the patients.

5.4 Theme Two: Managerial Factor

Participants were asked questions about managerial factors associated with the reliability and accuracy of health information in hospitals. They described three important sub-themes: the process of accessing information via computerised HIS; the training and cooperation between healthcare workers in using computerised HIS; and the reliability and accuracy of health information data.

5.4.1 Sub-theme 1: The process of accessing information via computerised HIS.

Participants' views showed that access to computerised HIS is controlled by user names or passwords given to each hospital employee. This process helps healthcare professionals reach patient information when they need it. For example, one participant (the manager of an IT department) said:

> Applying computerised health information system in hospital start by giving a user name and password for each healthcare employee in hospital; by using this user name and password the employee enters the system to start his documentations, but the documentation process depends on the job description for the employee. For example, the Registered Nurse can insert comprehensive nursing information for this patient but the assistant nurse cannot insert just the patient's information to the system.

This suggests that healthcare workers can access a patient's information in any department by using and user names or passwords. For example, one participant (a technical manager) said:

> One of the most important factors that enhance the application of computerised health information systems in hospitals is patient security or security of patient information. That means that not just any employee reaches patient information when they need it in departments or in the clinics, just by using the user name or password for this employee. From this point, the system records electronically who is the employee who inserts this information.

5.4.2 Sub-theme 2: Training and cooperation between healthcare workers in using computerised HIS.

Participants described the importance of education and training for all healthcare workers in the use of the computerised system before its implementation or use, because the implementation of such systems is new to Jordanian hospitals. For example, one participant (the manager of a radiology department) said:

> Before starting to work on a computerised health information system program in hospital, there are specialist persons from the responsible company for this program to start the training process for group healthcare workers to use this program. The employees of this group were from all hospital departments, depending on the contract with the company that is responsible for the program.

Regarding the training of healthcare workers, another participant said:

> The training process for the healthcare workers was one of the most important factors that assisted the implementation of the computerised health information system process in the hospital. The duration of the training was around one month for most hospitals employees. After that, we started a training process for new

> healthcare workers by the old healthcare workers. They had trained before to use this system and they taught new employees to use this system in all hospital departments. That means there is one employee at least in each department responsible for training new staff to use the health information system in the hospital.

A participant from the private sector (the technical manager of a hospital) said:

> Dealing with the training process for healthcare workers is the same as for other health sectors in Jordan, but in a different way. In the beginning of applying the healthcare system in the hospital, the training was for the key persons of the departments or the coordinators of hospital departments. After that, the department's coordinators starting the training process for the other healthcare workers in all hospital departments.

Participants also focused on contact between healthcare workers through the use of computerised HIS in all departments, and the contact and cooperation between professional healthcare staff and health informatics staff. The contact between healthcare workers is easier and better than before the installation of the computerised system. For example, one participant from a governmental hospital (the manager of a medical records department) said:

> One of the other factors that enhances the development and implementation of a computerised health information system is that the contact process between healthcare workers became clearer and easier in all hospital departments. For example, the direct contact between the healthcare workers in admission department and the surgical ward, pharmacy, laboratory and X-ray department made the process of getting information for any patient admitted to hospital easier. The healthcare workers can find the medical information when it is ready after

> entering this information into the system. This process was clear after applying the health information system in the hospital, and we observed that rapid contact between healthcare staff in all hospital departments.

Cooperation and contact between healthcare workers is easier and better than before the existence of computerised HIS in the hospitals. This is because patient information is supervised, and medical care staff exchange information through the system. For example, one participant from an educational hospital (the managerial manager of the hospital) said:

> The cooperation process from using the computerised HIS was completely clear. For example, before applying this system, the cooperation was available, but in a weak and slow way. In detail, the treatment of patients in medical ward needed some tests and investigations, and these tests needed time to be sent to the laboratory and wait until these blood samples are sent and the test coming back to department needs more time, and this will affect the patient's status if he needs an urgent procedure but they cannot do this operation before get the result. But after applying the health information system, the form for the test is inserted into the system directly, and the laboratory technician knows that this test is urgent and they will start to do it suddenly, and the result will be in the department after the laboratory technician inserts it into the system.

5.4.3 Sub-theme 3: The reliability and accuracy of health information data.

Most participant**s** mentioned that the reliability and accuracy of the computerised HIS was clear after the system was installed in the hospital. The majority of participants saw that applying these programs increased the accuracy of patient data entered into the system, because the system gives information on the data and the person who entered it. Also, after the installation of the system, participants observed its reliability and accuracy

as it decreased medical errors in all hospital departments. A participant (the head of a nursing department) said:

> All hospital departments including the accounting department are contained in the computerised health information system that has been applied in the hospital for more than five years. That means that the system is comprehensive for everything for the patients, from admission to discharge. During this period, all health information is documented in patient files in a reliable and accurate way by all health staff, because there are two means of supervision for all health staff. The first is the manager of each department, and the other way, more accurate more than first way, is the automatic electronic recording by the system of each procedure for any patient. This recording gives the time and the employee that did this procedure for each patient in the hospital. So this process has increased the reliability and accuracy of health information data for all patients in the hospital.

The accuracy and reliability of the computerised HIS applied in the hospital is the most important managerial factor, and suggests the importance of the changes that have occurred after the application of HIS. Another participant (the manager of an IT department) said:

> Also a factor that enhanced the application of the computerised health information system in the hospital is the electronic supervision of all health staff in hospital, because there is supervision for staff work in the hospital. This point gave the employee more attention for her work in the hospital to do it in the right way and this point was the most important point that decreased the medical errors in the hospital, because it is an easy way to detect who is the employee is who made an error. So for that, all the health staff started to do everything in a right and accurate way.

5.4.4 Sub-theme 4: The satisfaction of professional healthcare staff.

During the early stages of the implementation of computerised HIS in Jordanian hospitals, the majority of participants were resistant to the project, because it was new to them. They were used to traditional ways of working in hospitals. There was a perception that HIS would increase stress, with negative effects on work and patient care. Five years after the installation of the system, the healthcare workers had accepted the project, after seeing its positive effects on the quality of healthcare and the improvement of documentation and accountability. One participant (a technical manager) spoke to this point:

> In general, the acceptance of this experiment was very slow because most of them are old employees, and the average of their experience was around seven years, and they were habituated to the traditional way of using paper files and having a little bit of supervision. But this stage disappeared after the program had been applied for approximately five years, because most of employees had learned to work in this program. The most important thing was that they observed the benefits of this program for them and for the patients, such as a decrease in medical errors, prevention of medical staff from the mistakes of a specific employee who made a mistake, and the quality for the patients improved. Also, the length of stay in the hospital is decreased. I mean that the quality of patients in all hospital departments improved after the computerised health information system was implemented in the right way.

Most of the resistance described was from older, more experienced medical staff, because their work depended on paper files. This programme was a new idea, requiring them to change their traditional approaches to patient care and documentation. Conversely, new healthcare workers accepted computerised HIS, because it was clearly

the right way to care for patients, and because it conserved workers' rights. This point was clear when it was observed that the application of computerised HIS prevented new health staff from making mistakes or medical errors, because there were policies against and retribution for such mistakes. One participant (the head of a nursing department) said:

> One major effect of implementation of the computerised health information system in the hospital was the health staff thinking about this program, and they were not restful about this program, because they were familiar with the paper file program and they did not trust the information from this program in the beginning. Also, they think this program does not improve the healthcare process for the patient and for the medical staff, and they think that the idea of this program is just to catch their mistakes. But after adaptation to this program, they saw different things and the benefits of this program for them and for the patients. The new health professional staff in the hospital adopted this program in a short period, because they saw the benefits of this program for them and for patients.

5.5 Theme Three: Functional and Technical Factor

The study focused on the functional and technical factors together, as they are closely linked in Jordanian hospitals. These factors focus on the following general ideas:

1. The way of using computerised HIS in hospitals.
2. Time and effort taken to implement computerised HIS in hospitals.
3. How computerised HIS facilitate decision-making processes for healthcare workers in designing a patient's treatment.
4. How healthcare workers use all applications of computerised HIS in their work.
5. How computerised HIS provide healthcare workers with the information they need in the treatment process.

6. How computerised HIS provide all results and reports for all patients as entered into the system, from admission to discharge.
7. How access to the information in computerised HIS eases the work process for healthcare workers.
8. The instructions for using computerised HIS for any procedure.
9. The updating process for computerised HIS.

These ideas were gathered under four major sub-themes: the uses of computerised HIS; the decision-making process; the merging of computerised HIS with healthcare workers' work; and the updating process of computerised HIS.

5.5.1 Sub-theme 1: The uses of computerised HIS.

Participants agreed on healthcare workers' use of computerised HIS, noting that restrictions are applied so that workers can only access the relevant pages of the system. When employees enter their password and user name into the system, they can open patients' pages, but with limits. For example, a nurse entering a patient's page can see the patient's history, medication orders, laboratory requests, results and other things, but cannot change any information. A nurse can insert nursing notes, send requests to another department and get a patient's reports, but cannot make changes to other aspects. There are many uses for computerised HIS in hospitals, such as admission data and doctors' orders. One participant (the manager of a department of quality) said:

> From applying the computerised health information system in hospital, the medical staff can access to patient page; for example, the general physician can open the patient file and check his blood tests or any other laboratory investigation, X-rays, medical reports, and after he enters his order for this patient, also the specialist can access all patient information in his clinics when he wants to see that patient or any other patient.

This process does not occur with paper files. The HIS facilitates the retrieval of past patient information if patients are readmitted to hospital. Another participant (a managerial manager) said:

> Related to this hospital, the healthcare staff became familiar with collecting all patient information such as patient medical history, medical investigations, medical reports, previous operation history, and all patient medications he take all these things became familiar to the medical staff. This is one factor from many other factors that enhanced development and implementation of computerised health information system program in the hospital, because they observed the positive effect of this program on the healthcare process.

Implementing computerised HIS in Jordanian hospitals was the most important way of enhancing these hospitals, and allowed them to earn accreditation certificates for quality healthcare. This did not only occur because of the application of computerised HIS in hospitals; it also occurred because these systems were implemented according to standard criteria and because improvements to the quality of healthcare and to patient satisfaction could be observed. The most important outcome was to encourage other Jordanian hospitals to implement computerised HIS and gain accreditation certificates, because such certificates are important in attracting more national and international patients, as well as in acquiring financial benefits. One participant (the manager of a pharmacy department) said:

> The implementation of the computerised health information system program enhances the hospital to get to get many international accreditation certificates such as ISO9001 and JCIA. And these certificates encourage people form Jordan or any other countries to come to this hospital for health treatment, because these certificates are good indicators for the high quality of healthcare.

5.5.2 Sub-theme 2: Decision-making process.

The majority of interviewed participants agreed that the implementation of computerised HIS improved decision-making processes for patient treatment, especially in critical situations. Such processes prior to the initiation of the computerised system were very slow, because much information was needed in order to make suitable treatment decisions for patients, including patient history, medical investigations and consultations. Computerised HIS allow quick retrieval of appropriate additional information, and quicker treatment decisions. One participant (the head of a laboratory department) said:

> Through the application of the computerised health information system program, it became useful for the healthcare staff to give them comments to take suitable medical decision-making. For example, during a medical investigation for the patient using a blood test, if the results appear abnormal in the laboratory, this result appears directly on the ward of that patient, so at this time, the nurse and general physician see that abnormal result and they start to make decisions about how to manage this case.

Decision-making processes can be time-consuming for medical staff. Computerised HIS have reduced waiting periods for patients, as patient history, medical investigations and consultation reports can be retrieved quickly, enhancing the ability of healthcare workers to make suitable treatment decisions in a short time. This has improved the quality of healthcare for all patients. Another participant (the manager of a radiology department) said:

> Apply a computerised health information system has a clear positive effect on the treatment process of patient. For example, before applying this system, when they needed to make any CT scan for the patient, they needed to send a form to the

> radiology department. Then when the request arrived at the radiology department, the medical staff checked manually for empty time in which to give an appointment to this patient. After that, the staff of the radiology department sent this data to the ward of that patient, and this process took a long time to make this test. But after implementing the computerised health information system in the hospital, this procedure took a short time because the process took a short time. That means that when the nurse inserts a request for a CT scan on the program within minutes, the nurse gets the time of this investigation, because the program made this order automatically, depending on the information of the hospital patients. Also, when the test is done, the report arrives to the department or to the physician in a short time; then the medical staff take treatment decision in a short time. From this example, we observed the long-time of stay for the patient will be short, so the treatment period will be short. This is clear clue to the improvement of patient care in hospital after we applied a computerised health information system.

In private sector hospitals, the focus is on the implementation of computerised HIS programs, not just for accreditation certificates or decision-making but because the rapid decision-making process results in financial benefits for the hospital. This is evident from the fact that the number of patients admitted to the hospital increased during a specific period, which is related to a decreased length of stay. In the other hospital sectors, patient treatment cost containment was considered. One participant (the technical manager of a hospital) said:

> The cost containment process was clear through the time-consuming or decreasing the length of stay period in the hospital. For example, when the patient was admitted to hospital for treatment, and the length of stay of this patient decreased

> from two weeks to one week, related to rapid decision-making process and related to the general idea that implementing a computerised health information system in the hospital meant a rapid treatment process and decrease the long of stay in hospital, all these things will increase the number of patients they admitted to hospital and increase the financial benefits for the hospital.

5.5.3 Sub-theme 3: Merging computerised HIS with healthcare workers' work.

There are many technical aspects to implementing computerised HIS in hospitals, such as the merging of professional healthcare staff's work. This merging appeared in many procedures. First, computerised HIS provide medical staff with sufficient and precise information. One participant (the manager of an information technology department) said:

> The most important thing after implementation of a computerised health information system in hospital is that the medical staff in hospital wards cannot make any medical procedure such as giving medications or any clinical investigation if they do not find it documented in the electronic file of the patient. An example of this point is the amount of prescription of medications. The patient will take this medication for specific periods and cover this period, not more or less.

Second, computerised HIS provide clear output information, making work at the hospital easier. A participant (the manager of a medical records department) said:

> One of the most important factors that support implementation of the computerised HIS in hospital is the high speed to get the medical output information such as investigations results or medical reports from other hospitals or other departments of hospitals. To clarify this point, we compare getting medical information for a newly admitted patient in hospital such as a patient

> history or blood test, before implementing this program. We get contact with the patient history from the old file of the patient if we find it, but in general, the patient file is lost when the patient leaves the hospital for a long period, and when he comes back one year later, we cannot find his file, and we need to make a new file to get history such as previous reports or previous investigations. This procedure needs more time. But after implementing this program, when the patient comes back to hospital after many years, we just we need to enter his national number and his name to check his electronic file to get complete output information and treat him in a short period.

5.5.4 Sub-theme 4: Updating process of computerised HIS

Continual and regular updating of computerised HIS and computer equipment is essential. Participants described the importance of this process, their dissatisfaction with its implementation and the unbudgeted expenses associated with it. Updating is necessary for any computer program implemented in hospitals, because the purpose of an information system is to improve healthcare processes. This policy is applied in all developed countries, but most hospitals do not focus on this policy, either in Jordan or other developing countries. The updating process is as important as implementation, but participants considered the management of computer problems and the updating and development process of HIS to be the major problem faced in the development and implementation of such systems in Jordanian hospitals. The manager of an information technology department said:

> The development process of the computerised health information system program in hospitals is a continual process. For example, for each station or ward, there is a computer, and every five years, we are bring a new computer to each station or ward in the hospital. Also, if any problem happens to the computers or to the

> system in hospital, there are specialist staff in the information technology department responsible to manage this problem in the system or in the computers. This process was applied in this hospital more than seven years ago, when we started work in this program in the hospital, but the updating process for the implemented system in the hospital is not applied, because the updating process needs a new budget to bring specialist staff from the company that sold this program to the hospital, and this company needs more money to update this program or bring a new health information program.

5.6 Theme Four: Benefits of HIS

Some benefits of computerised HIS are not immediately evident in all hospital departments. The major goal of implementing such a program is to receive the benefits that other departments have experienced, as well as to derive new benefits. There are many benefits from implementing computerised HIS in hospitals: for patients, professional healthcare staff and the hospital. In this study, five major benefits were uncovered, depending on the data collected from the participants. These benefits were arranged into five sub-themes.

5.6.1 Sub-theme 1: Improvements to the quality of patient care.

The first benefit from the implementation of computerised HIS programs in all hospitals was an improvement in the quality of healthcare. The main purpose of the implementation was to improve the quality of healthcare. There was clear evidence of improvement in the quality of healthcare in both developed and developing countries, in hospitals that had implemented computerised HIS. One participant, the head nurse of a hospital, said:

> There are many benefits we observed five years after implementing the computerised health information system. The important benefit was the

improvement the quality of the healthcare process for patients. We observed these benefits after comparing the quality of the healthcare process for patients before and after implementing this program. This improvement we summarised in specific points such as: Increase the electronic documentation for patients in all hospital departments, and we can get at any time. The continuity of the treatment process for patients who are admitted to hospital many times. Getting all tests and investigations in a short time. Decreasing the percentage of medical errors.

5.6.2 Sub-theme 2: Enhanced decision-making processes for patient care.

The most important aspect of treatment processes in hospitals is decision-making when treating patients, because medical healthcare staff cannot start treatment before making the right diagnosis. The implementation of computerised HIS enhances the ability to reach the right diagnosis, through reducing time-consuming activities, such as collecting patient history from old electronic files, conducting tests and medical investigations quickly, starting treatment earlier and finishing it in a shorter time. This process increases hospitals' productivity.

The high speed of completion of the medical treatment process, through rapid decision-making in diagnosing and treating a patient, was one of the most important factors in the implementation of a computerised HIS in the hospital. This change was clear when comparing the use of electronic patient files with that of paper files. Applying the computerised HIS enhanced the decision-making capabilities of all medical staff, including doctors, nurses and pharmacists, who depend on accurate and sufficient information being in the system.

5.6.3 Sub-theme 3: Enhanced cooperation and contact between healthcare professionals.

Contact between healthcare professionals in hospitals before the implementation of computerised HIS was weak, because they did not have direct or immediate contact. The implementation of HIS has enhanced cooperation and contact between staff. Contact can occur directly between staff. The electronic documentation of contact regarding orders enhances cooperation between all professional healthcare staff in all departments, further improving the treatment process of patients. As one participant, the head of a nursing department, said:

> The contact between medical staff in hospital became easier after implementation of the computerised health information system program in the hospital. The physician in the hospital can find the patient file from any computer in the hospital by using a specific user name and specific password for each member of the healthcare workers, and he can insert the medical order into the system after he sees the patient's file and new investigations or test; if the patient needs an urgent order, then this order will appear directly in the ward of that patient. Also when the physician or nurse or any other healthcare staff need any information for their patient, they can get it in a short period after entering the request for that information to any department in the hospital. This benefit enhances the medical staff's working together as a team in the hospital.

5.6.4 Sub-theme 4: Patient security.

An important consideration in the implementation of computerised HIS is patient security. Sometimes, patients do not want others to know about their medical case because they consider this information private. Before implementing computerised HIS, patient information was contained in paper files that any member of the medical staff

could see. Such information could be distributed to patients' relatives, which was unacceptable to patients in developing countries, such as Jordan. Implementing computerised HIS prevents open access to files. Only responsible, professional healthcare staff and medical staff can access files, and they cannot make patient information widely accessible. The system also detects and electronically documents the opening of electronic patient files, and such supervision improves security. One participant, the manager of a department of quality, said:

> Another benefit of using the computerised healthcare information system program in the hospital is the policy of patient security. This policy started from the beginning of the implementation the program in the hospital, so each employee has a special code or password to enter into the hospital's computerised health information program, and there is limit for each employee in this system to open just specific pages from the system related to employee work responsibility. For example, a medical records employee can see the admission information of the patient as demographic data, and the diagnosis and health insurance, but the nurse and physician can see most patient information.

5.6.5 Sub-theme 5: Improvement and development of scientific health research processes.

Scientific research is very important in the health field, specifically the study of diseases, medication and anything else relating to patient health. Clear differences on this subject can be observed before and after the implementation of computerised HIS. Before implementation, the collection of data from a patient's file was very difficult, as it took a long time. Further, patient information was not always completely accurate, and it was difficult to return to files and check their accuracy. After the implementation of computerised HIS, data collection became easier, as information was collected

automatically by the system. Therefore, healthcare workers need less time to collect and check the accuracy of information. The implementation of computerised HIS facilitates the research process as researchers can find and check health simply, using the system. One participant, the manager of an IT department, said:

> There are many benefits from an implemented computerised health information system program in hospital; one of these benefits is the health information and statistical data used in the health research process, such as the number of cases for each disease in all departments in the hospital through a specific period. For example, the researcher can calculate the number of hypertension patients in an easy way, in order to publish a paper about the prevalence and incidence of hypertension in the last year. So we can collect this information in an easy way and a short time by using this program in hospital. Also, this program automatically, at the end of each year, gives us an annual report for all statistical information we need to put in annual statistical reports book.

5.7 Theme Five: Barriers to Computerised HIS

The implementation of any program intended to improve work processes in a hospital will face some barriers. These include updating processes for the program and cultural factors, such as the acceptance of the new system by older employees. While benefits have been observed in Jordanian hospitals, barriers facing the implementation of computerised HIS programs can be categorised under three sub-themes.

5.7.1 Sub-theme 1: Updating processes.

Any computer program needs updating annually, as improvements are made to the program. Computerised HIS require a policy stating that they will be updated every year, in order to attain accreditation certificates for the improvement of the quality of healthcare in hospitals. In Jordanian hospitals, the main barrier to the implementation of

computerised HIS programs was the updating processes for these programs. The programs had been run in the hospitals for five years or more without updating. This is because the system stops working when it is being updated. One participant, the managerial manager of a hospital, said:

> The updating process for the computerised health information system program in hospital is a continuous process. This means that for any problem happening in the program in any department of hospital, the manager of this department makes direct contact with the information technology department of the hospital to come suddenly to manage this problem. Also, the information technology staff in hospital are very cooperative to solve and manage any problem in the program. The hospital in this period looked to implement a new program, because the implemented program had started more than ten years ago.

5.7.2 Sub-theme 2: Shortage of resources.

The implementation of computerised HIS requires the necessary resources, such as computers, printers, storages facilities for the equipment and responsible staff to manage the program. However, Jordanian hospitals are short on computers. For example, in the male medical ward of one hospital there was just one computer, which is not sufficient because hospital wards require at least two computers. The explanation given for this shortage was insufficient funds. As one participant, the manager of an IT department, said:

> From the problem that faced hospital in implementation the computerised HIS was the insufficient of the number of computers in the hospital, for example, each ward or station there is just one computer, this the major problem faced the hospital after implemented this program, so if the ward computer not functioning or stopped working the electronic contact and documentation will be stopped until

> the information technology staff manage this problem and if the computer not work and we need new computer we need to make urgent request to managerial department of hospital to buy new computer and this process need long period and the electronic documentation and contact will be stopped until we bring new computer. Also the numbers of information technology staff in hospital not enough to make controls for these barriers, because the information technology staffs working just in morning shifts.

5.7.3 Sub-theme 3: Resistance to the program.

The implementation of any new computerised programs will face resistance, as staff are familiar with old programs. Resistance will decrease, and disappear over time, if the program is implemented properly. It was observed in this study that the implementation of computerised HIS programs faced strong resistance at the beginning from older staff. This took a long time to decrease, and did not completely disappear. This was in addition to other barriers still facing the implementation of computerised HIS in Jordanian hospitals. One participant, the head of a nursing department, said:

> Among the barriers and issues that faced the implementation of a computerised health information system in the hospital was the unwillingness of older staff, the old specialists and old nurses from the staff whose experience in the hospital is more than twenty years. They are accustomed to paper patient files, and also, related to their cultural thinking; it is difficult to learn a new program, needing a new learning style and training course.

5.8 Summary of the Qualitative Results

Thematic analysis was performed on the qualitative data using NVIVO software version 10, in-line with previous studies. The qualitative data collection and analysis began with the transcription of all notes and audio recordings. They were stored

electronically, and hard copies of all relevant documents were kept. The data were then coded manually, according to analytical themes. This is a conventional analytical strategy, whereby specific theory or theories are used to inform the collection of data and subsequent analysis (Walsham & Sahay, 2006). Within this iterative process, the researcher highlights themes from different data sources, detailing the most recurrent or significantly-pronounced themes for the narrative (Soto, Tarrant, Pritchard-Jones & Dixon-Woods, 2012; Walsham & Sahay, 2006).

This study's analysis summarised the five emergent themes, each further divided into sub-themes that emerged from the participants about the implementation processes of computerised HIS. These themes were organisational factor; managerial factor; functional and technical factor; benefits of computerised HIS; and barriers to the implementation of computerised HIS. The study found the same quantitative results.

Chapter 6: Discussion

6.1 Introduction

The use of computerised HIS is linked to improved health outcomes. This study has investigated the factors promoting or hindering the implementation and development of computerised HIS in Jordan, a developing country. The following research questions are the focus of the study:

1. What are the factors promoting the development and implementation of computerised HIS in Jordan?
2. What are the factors hindering the development and implementation of computerised HIS in Jordan?
3. What are the benefits of developing and implementing computerised HIS in Jordan?
4. What are the barriers to developing and implementing computerised HIS in Jordan?
5. What effect do participants' backgrounds have on their responses to the questionnaire on factors promoting or hindering the development and implementation of computerised HIS in Jordan?

This chapter is divided into four sections. In the first section, the quantitative and qualitative results will be discussed, together with an integrative approach to mixed-methods research for all factors and benefits, taking group difference into account (Creswell & Plano-Clark, 2011). In the section concerning barriers, only qualitative results are discussed. The fourth section provides a conclusion, recommendations for further study and the limitations of the current study.

In Chapter 4, analysis of the six factors promoting or hindering the implementation and development of computerised HIS in Jordan was presented. These

factors were: organisational (23 items), managerial (four items), functional (four items), technical (two items), cultural (two items) and legal (three items). In Chapter 5, qualitative analysis was presented, which revealed three major themes relating to the factors arising in the quantitative analysis. These were organisational, managerial and functional and technical themes. The factors and themes from both the quantitative and qualitative analyses must be considered when implementing new HIS, which aim to improve the quality of healthcare and safety, reduce costs and increase the efficiency and effectiveness of work processes.

The results of this study confirm the findings of earlier research, but identify the importance of these findings for Jordan, a country that had not previously been studied from this perspective. The findings of the quantitative and qualitative sections of this study will be presented together in this chapter as integrated results, wherever possible. The analysis summarises the benefits of computerised HIS in Jordanian hospitals, grouped into two categories: clinical and organisational. These categories were derived from the current literature, as well as from analysis of the data. There were five clinical and seven organisational benefits of this study.

6.2 Factors Promoting or Hindering HIS Implementation in Jordan

In this section, the quantitative and qualitative results for the factors promoting or hindering HIS implementation, including the effect of the background variables of respondents, will be discussed. In each case, the quantitative and qualitative results will be discussed together, followed by discussion of the findings significant in relation to the background variables**.**

6.2.1 Summary of quantitative and qualitative results.

The descriptive demographic data for all hospitals were collected across six demographic variables. Regarding gender, 284 males participated (52.6 per cent) and 256

females (47.4 per cent). Four occupations were included: manager, physician, nurse and other health staff (medical records employees, laboratory technicians, pharmacy staff and radiology staff). The study included 53 managers (9.8 per cent), 74 physicians (13.7 per cent), 269 nurses (49.8 per cent) and 144 other health staff (26.7 per cent). Four age groups were included: 25 to 29 years (42.2 per cent), 30 to 39 years (36.9 per cent), 40 to 49 years (18.5 per cent) and 50 years or above (2.4 per cent). Levels of education included diploma (45, 8.3 per cent), Bachelor's degree (461, 85.4) and postgraduate degree (34, 6.3 per cent). Eight work departments were included: emergency room (21, 3.9 per cent), medical (257, 47.6 per cent), medical records (47, 8.7 per cent), surgical (89, 16.5 per cent), accounts (31, 5.7 per cent), laboratory (38, seven per cent), radiology (23. 4.3 per cent) and pharmacy (34, 6.3 per cent). Length of work experience included four periods: three to five years (37.8 per cent), six to 10 years (27 per cent), 11 to 15 years (16.7 per cent) and 15 years or more (18.5 per cent). This data indicates that the participants were representative of Jordanian hospital health staff (MOH, 2013).

The study analysed the six factors promoting or hindering the development and implementation of computerised HIS in Jordan. All factors were shown to have a positive effect on participants' views of HIS implementation.

In the qualitative analysis of the issues relevant to the factors, three major themes emerged: organisational, managerial, and functional and technical factors. These themes should be considered when implementing new HIS, which are intended to improve the quality of healthcare and safety, reduce costs, increase the efficiency and effectiveness of work processes and improve patient care processes. The discussion of the six factors and three themes, along with the barriers and benefits, are presented below. This combined analysis has been divided into five major constructs: organisational; managerial; functional and technical; benefits of computerised HIS; and barriers to computerised HIS.

The factors that promote the implementation of HIS are described as positive, and those that hinder as negative.

6.2.2 Organisational construct.

The organisational construct was considered to be important in this study, taking into account the results shown in Table 4.2, regarding healthcare staff views on the use of computerised HIS. The qualitative results supported the finding that the organisational construct was important in the implementation of HIS in Jordan. Therefore, both the quantitative and qualitative results support HIS implementation in Jordan. The results identified four sub-organisational constructs important to the development and implementation of computerised HIS in healthcare settings in Jordan. Healthcare workers' suggestions on the use of computerised HIS were taken into account, as well as the changes suggested to improve work.

Four organisational sub-constructs were identified from the combined data. They were: improved quality of healthcare processes; accuracy and comprehensive nature of health information; the effect of computerised HIS on healthcare workers; and the policies of computerised HIS.

6.2.2.1 Improved quality of healthcare processes.

The findings indicate that most interview participants agreed on the importance of computerised HIS for the improvement of the quality of healthcare. Several participants reported that the system improved communication between medical staff in hospital departments, and between Jordanian hospitals (organisational factor, item four). The findings indicate that one effect of this system was to increase the speed of treatment processes, and to improve the quality of healthcare processes, especially regarding medical decision-making and diagnosis. The study also found that the changes introduced by computerised HIS were important for daily work, and that staff needed to be aware of

this when adopting the system (organisational factor, item one). The results also indicate that a successful computerised HIS should connect groups of healthcare staff, respond to their needs by helping in decision-making processes and that the system must be accurate. For example, participant two from RMS Hospital, said:

> In the past, the paper file problem was the most important issue to implementing the computerised health information system in the department to make the healthcare process easy and also make the work of health staff easy. For example, the information of patients was stored on paper, and these files most of time became lost in the shelves, so when the patient was admitted to hospital on another occasion he needed a new file and a new admission process that included the patient history and all investigations, and these take a long time. But the computerised HIS solves this problem, as inserting the patient medical number or the patient name then makes all patient information appear in the system. The old process was time-consuming for patient treatment. So this process has improved the patients' healthcare process.

High-quality information is critical at all levels, to ensure that proper medical decisions are made: correct diagnosis leads to quick and correct treatment (Carmine & Daniel, 2007; Chow, 2013; Fraser & Blaya, 2010; HIS Knowledge Hub, 2009; Mair et al., 2012).

The sharing of suggestions between healthcare workers in the decision-making process supports the successful adoption; implementation and development of computerised HIS in hospitals. It also supports improved management from those responsible for the adoption, in two ways (organisational factor, items 2, 3 and 4). First, it identifies that computerised HIS requires good goal setting or strategic planning, and second, it identifies improved decision-making processes. This is supported by previous studies

(Carmine & Daniel, 2007; Chow, 2013; Frabotta, 2002; Mair et al., 2012; Wang et al., 2005; Wang et al., 2014; Zhang, et al, 2013). The qualitative analysis further noted a perception of improved healthcare quality, comprehensive and accurate health data and effective computerised HIS, which positively affected healthcare staff and polices.

6.2.2.2 Accuracy and comprehensiveness of health information.

This study suggests that implementation enhanced the accuracy and comprehensiveness of health and medical information in Jordanian hospitals, which may have decreased medical errors. The results also focus on computerised HIS as a comprehensive program. The general application of this program in Jordanian hospitals improved healthcare processes and supported healthcare workers, by allowing them to find current and historical patient information required for care quickly. For example, participant one, from KAUH, said:

> A decrease in the number of medical error cases for all healthcare workers in all hospital departments, especially for laboratory, pharmacy, and medical records. For example, when the doctor write the medication prescription he enters the prescription to the system, then it is gone to pharmacy, the pharmacist receives the prescription electronically, and he prepares to an electronic document this medication for this patients and sends it to the department. This process forces the doctor and the pharmacist to recheck the order and information to be sure about it, because the system identifies who is the person who makes a medical error.

It is evident from this and previous studies that the accuracy of health information has improved since the implementation of computerised HIS, leading to an improved quality of healthcare. The findings of this study also indicate that the attitude of healthcare workers in all hospitals is cooperative, making it easier to gather patients' health information quickly. The implementation of computerised HIS improved and

enhanced healthcare processes for patients and healthcare workers. This confirms the findings of earlier studies (Carmine & Daniel, 2007; Frabotta, 2002; Health Information Systems Knowledge Hub, 2009; Mair et al., 2012).

6.2.2.3 The effect of computerised HIS on healthcare workers.

The primary view was that computerised HIS had positive effects on the work of healthcare staff, because they considered their work environment to have become more manageable. Interview participants agreed that the use of a security code to enter or check patients' information was effective. For example, participant one, from HH, said:

> The most effect of implemented computerised HIS in hospitals is easier medical staff work. For example, when the doctor and nurse want to get information about laboratory blood result, he needs to wait until the result comes from the laboratory; then the doctors and nurse start applying the order, and this takes more time from the medical staff, but when the medical staff get the information direct from the system, this helps them to start their work directly, and this is makes their work more easy because they finish it in a short time.

This confirms what was found in earlier studies (Carmine & Daniel, 2007; Chow, 2013; Fraser & Blaya, 2010; Isabalija et al., 2011, Kotter, 2007; Mair et al., 2012).

6.2.2.4 The policies of computerised HIS.

This sub-construct was considered important by the majority of participants. They agreed that polices on computerised HIS were effective for their work. Computerised HIS ensured that medical errors were reduced, as the system controls healthcare processes for workers. For example, the system performs duplication checks for medical orders, and supervises medical practice by electronically documenting everything. The results also indicate that one of the policies related to the introduction of computerised HIS improved patient privacy. For example, only healthcare workers are allowed access to patients'

medical information, using their employee security codes. This protects the privacy and security of patients' information. For example, participant two, from RMS Hospital, said:

> One of the most important factors that support applying a computerised HIS in hospital is a decrease in medical errors through applying computerised HIS to checking and rechecking the medical information for the patients before any medical procedure, also because the employee now can see electronically from this system who is the person who did that procedure. After detecting the employee who made this medical error, there is punishment for this person for this medical error and for each employee who makes medical errors for the patients.

This sub-construct improves the quality of healthcare processes. In Jordanian hospitals, a decrease in medical errors five years after the implementation of computerised HIS was evident, as the policies and punishments for making mistakes were clear. The time taken to check for errors in medical orders decreased, and the quality of healthcare processes improved. These findings confirm those of previous studies (Amin et al., 2011; Isabalija et al., 2011).

There are legal penalties for healthcare workers who do not use computerised HIS correctly, and there are specific polices for use. The legal factor focuses on the policies, guidelines and penalties associated with computerised HIS, and the policies for implementing the system. The findings of this study indicate that the legal factor had a positive effect on the implementation of computerised HIS. The results also demonstrate the existence of specific usage policies. One such policy is the security code assigned to each healthcare worker, which is a private user name and password required to enter the system. By using this security code, healthcare workers can check patient information, medical documents required for treatment, treatment practices and laboratory tests.

The results also indicate the positive effects of fewer medical errors, due to the usage policies and penalties associated with computerised HIS. For example, the use of security codes makes it possible to detect when an employee makes a serious medical error. There are also policies regarding punishment of the employee(s) found to have made mistakes. The computerised supervision decreases the occurrence of mistakes, so the legal factor improves the quality of healthcare processes in Jordanian hospitals.

A major legal factor affecting computerised HIS in developing countries is the lack of policies, guidelines or and penalties related to the system, especially in hospitals. There is a lack of governmental support for the use and implementation of computerised HIS in hospitals, and a lack of laws protecting system practitioners in developing countries. This is supported in previous studies (Brender et al., 2006; Carmine & Daniel, 2007; Isabalija et al., 2011).

6.2.2.5 The effects of the organisational construct on background variables.

Other findings related to the organisational construct were significantly affected by participant age, work experience and profession. Those aged between 25 and 29 believed that the organisational construct was more important than the other age groups (see Table 4.13). This may have been due to younger participants beginning work after graduation, so being more willing to learn systematised approaches, such as computerised HIS. Also, those with 16 or more years' experience believed that the organisational construct was important. This may have been due to their experience with the younger workers, who saw the importance of organisational elements, such as the need for computers and computer systems; listening to their ideas and suggestions helped in the implementation of the HIS. Employees with over 16 years' work experience had witnessed the change from a manual to a computerised HIS, and may have struggled to adapt to the new system, so considered it problematic. Further, nurses reported feeling

less confident about the HIS. This may have been because as they had the most daily contact with patients, they were more likely to use the HIS frequently. The combination of being a nurse and older may provide further insight. For example, it was reported by the head of nursing in one hospital that:

> Old nurses from the staff whose experience in the hospital is more than twenty years. They are accustomed to paper patient files, and also, related to their cultural thinking; it is difficult to learn a new program, needing a new learning style and training course.

6.2.3 Managerial construct.

The managerial construct focuses on four sub-constructs, to explore the effect of the managerial factor on the development and implementation of computerised HIS in Jordanian hospitals.

The results of this study (see Table 4.2) show that computerised HIS in Jordanian hospitals are easy for all healthcare workers to use. They have access to information where and when they need it. However, the number of computers in hospital departments is reported as inadequate, in both the quantitative and qualitative results: around 50 per cent of participants perceived there to be a shortage of computers in their hospitals. Older healthcare workers helped staff learn how to use computerised HIS when first introduced. The time required to input information into the computerised HIS was reported as acceptable. Healthcare workers are confident about the reliability of data documented in the computerised HIS, but they believe that they did not receive adequate training in how to use the system. Four sub-constructs were identified under the managerial construct. They were:

1. The process of accessing health information through computerised HIS.
2. The training of healthcare staff to use computerised HIS.

3. The flexibility of implementation of computerised HIS.
4. The satisfaction of healthcare staff.

6.2.3.1 Accessing health information through computerised HIS.

Access to health information is controlled through the use of secret user names and passwords. This process helps healthcare staff access patient information where and when they need it. For example, one participant, the manager of an IT department, said:

> Applying computerised HIS in hospital start by giving a user name and password for each healthcare employee in hospital; by using this user name and password the employee enters the system to start his documentations, but the documentation process depends on the job description for the employee. For example, the Registered Nurse can insert comprehensive nursing information for this patient but the assistant nurse cannot insert just the patient's information to the system.

These findings confirm those of previous studies (Carmine & Daniel, 2007; Chow, 2013; Fraser & Blaya, 2010; Isabalija et al., 2011; Kotter, 2007; Mair et al., 2012).

Healthcare worker orientation on how to use computerised HIS was found to be an important managerial factor. This study found that neither the more experienced nor the newer healthcare workers received adequate training. Nor was there a systemic programme to acquaint new healthcare workers on how to use computerised HIS. This lack of knowledge was one factor having a negative effect on all four Jordanian hospitals studied. The results also indicated that experienced staff are the best people to help new staff in the use of computerised HIS during their orientation period. This type of support resulted in better implementation of the HIS by new staff.

The managerial factor's main focus is on the training and education of healthcare staff to use computerised HIS in their work, and to encourage its implementation in their hospitals. The available staff must be skilled in using the system. The training and

education of staff must be sufficient, and support for users extensive. The degree of healthcare workers' training and participation was related to changes made to the system in hospitals or other health sectors. This is supported by previous studies (Kouroubali, 2003; Mair et al., 2012), which found that the major factor for the successful implementation of computerised HIS was bringing skilled staff to the system, continually educating healthcare workers on the correct usage and teaching them about the benefits of the system for the improvement of the quality of healthcare processes. In other studies, a lack of training support and a lack of skills negatively affected the implementation of the systems, especially in developing countries. In Jordan, good support and training occurred more often in the private sector than in the governmental sector (Al-Yaseen et al., 2010). However, a lack of knowledge about the use of computerised HIS had a negative effect in both the public and private sectors, as found in previous studies (Carmine & Daniel, 2007; Fraser & Blaya, 2010; Isabalija et al., 2011; Mair et al., 2012).

The second qualitative result focused on the managerial construct discussed healthcare workers' previous positive experiences with computerised HIS and access to health information. The results focused on the training and cooperation between healthcare workers, and workers' satisfaction after using computerised HIS for a long period. This managerial theme is arranged into four sub-constructs, which are important for the development and implementation of computerised HIS in hospitals.

6.2.3.2 The training of healthcare staff in the use of computerised HIS.

The second sub-construct under the managerial theme is the training of healthcare workers to use the system in the correct way, and the cooperation between workers in using computerised HIS in Jordanian hospitals. The study revealed that neither older nor newer healthcare workers received adequate or realistic training in the use of the system, nor was there systemic training of new healthcare workers. This lack of knowledge is one

of the major managerial factors that have a negative effect on Jordanian hospitals. The results also indicate that experienced healthcare staff are the best people to help new staff use the system. Therefore, the focus of the managerial factor in this study is on the sufficient training and support of healthcare staff, and their sharing in the implementation process in hospitals. The degree of healthcare worker training and participation relates to the changes in system use in hospitals. For example, one participant, the manager of a radiology department, said:

> Before starting to work on a computerised HIS program in hospital, there are specialist persons from the responsible company for this program to start the training process for group healthcare workers to use this program. The employees of this group were from all hospital departments, depending on the contract with the company that is responsible for the program.

These findings are similar to those of previous studies (Kouroubali, 2003; Mair et al., 2012).

This study found that the lack of training for healthcare workers, as well as the lack of skilled workers, negatively affects the implementation of the system, especially in developing countries. It also found that support for training in Jordan is better in the private sector than the government sector. However, the lack of knowledge about computerised HIS in hospitals has a negative effect in both the public and private sectors. Jordan's private sector focuses on the quality of healthcare processes more than the public sector, in order to meet customer satisfaction through systematic training and qualified staff who can use computerised HIS properly. These findings confirm those of previous studies (Carmine & Daniel, 2007; Isabalija et al., 2011; Mair et al., 2012).

6.2.3.3 Flexibility of implementation of computerised HIS.

A third important finding for the managerial factor is the flexibility of implementation of computerised HIS in Jordanian hospitals. This study found that the reliability and accuracy of computerised HIS was clear after their installation. Participants saw that the programs increased the accuracy of patient data entry, because the system provides accurate information on both the data and the person who entered it. The findings of this study indicate that after the installation of computerised HIS, there was improvement in the reliability and accuracy of health information. For example, participants reported that medical errors decreased in all Jordanian hospitals, and that medical mistakes were reduced through checking for errors in medical orders. One participant, the head of a nursing department, said:

> All hospital departments including the accounting department are contained in the computerised HIS that has been applied in the hospital for more than five years. That means that the system is comprehensive for everything for the patients, from admission to discharge. During this period, all health information is documented in patient files in a reliable and accurate way by all health staff, because there are two means of supervision for all health staff. The first is the manager of each department, and the other way, more accurate more than first way, is the automatic electronic recording by the system of each procedure for any patient. This recording gives the time and the employee that did this procedure for each patient in the hospital. So this process has increased the reliability and accuracy of health information data for all patients in the hospital.

These findings are consistent with those of previous studies (Isabalija et al., 2011; Mair et al., 2012).

This study also found an improvement in the quality of healthcare in all hospital sectors. By assessing healthcare worker satisfaction, the study found that flexibility in implementation and management of computerised HIS was a factor affecting the success or failure of such systems in hospitals. The formal relationships between healthcare workers were improved after the implementation of the HIS, meaning that workers could access patient information any time and from any department. The time taken to document and check medical records or other health documents was considered acceptable. All of these components of the managerial factor had a positive effect on implementation, because healthcare professionals were satisfied with the computerised HIS. This satisfaction was clearly noted with respect to the time it took to document and access patient information.

There were four types of staff satisfaction: with the quality of the HIS interface; the quality of the functioning of the HIS; the quality of the performance of the HIS; and the quality of HIS interface, functioning and performance combined. As an example of these types of satisfaction, staff reported satisfaction with documentation time, and with access to information when and where they needed it, in all Jordanian hospitals. This is because all health staff must access patient medical information quickly, and the reduction in time improved healthcare processes for patients and staff. The flexibility and quality of healthcare processes in Jordanian hospitals was improved, a finding supported by evidence from previous studies (Amin et al., 2011; Mair et al., 2012).

Flexibility in the implementation and management of computerised HIS requires improved public relationships, and the motivation of healthcare workers to use all tools of the system. The most important aspect of the managerial factor regarding the implementation of the HIS is positive interpersonal relationships, and the absence of tension in the project team. This means that all members of the team know their roles and

responsibilities, which helps prevent conflict in work processes after system implementation, as found in previous studies (Amin et al., 2011; Mair et al., 2012).

6.2.3.4 Health care staff satisfaction.

In the first stage of the implementation of computerised HIS in Jordanian hospitals, the majority of healthcare workers were resistant to the project, as it was new to them and they were used to traditional paper files. The results of this study showed staff initially believed that the program would increase their daily work stress, and have negative effects on patient care. Five years after installation, healthcare workers reported their acceptance of the project, after witnessing its positive effects on the quality of healthcare, such as improved documentation, accuracy and staff accountability. One participant, a technical manager at a hospital, stated:

> In general, the acceptance of this experiment was very slow because most of them are old employees, and the average of their experience was around seven years, and they were habituated to the traditional way of using paper files and having a little bit of supervision. But this stage disappeared after the program had been applied for approximately five years, because most of employees had learned to work in this program. The most important thing was that they observed the benefits of this program for them and for the patients, such as a decrease in medical errors, prevention of medical staff from the mistakes of a specific employee who made a mistake, and the quality for the patients improved. Also, the length of stay in the hospital is decreased. I mean that the quality of patients in all hospital departments improved after the computerised HIS was implemented in the correct way.

Within the managerial construct, the critical cultural factors that affected the implementation of computerised HIS were healthcare workers' resistance to change.

However, they began to accept it once they understood the benefits. Reported benefits were the improved quality of patient care and improved quality of staff practice. The adoption of computerised HIS in hospitals eventually succeeds, confirming findings from previous studies (Carmine & Daniel, 2007; Heckley, 2004; Isabalija et al., 2011; Mair et al., 2012).

Other findings were that the managerial factor was significantly affected by the age and work experience of participants. Those aged between 40 and 49 reported the managerial factor to be more important than the other age groups did (see Table 4.13). Also, those with more than 16 years' experience perceived the managerial factor as important. Managerial factors had a positive effect on participants with 16 years' work experience, and nurses.

6.2.4 Functional and technical construct.

The functional and technical construct of this study focuses on three major sub-constructs, to explore its effects on the development and implementation of computerised HIS in Jordanian hospitals. They are:

1. The use of the computerised HIS.
2. The flexibility of the computerised HIS.
3. The updating and development process of the computerised HIS.

The effect of this construct on the development and implementation of computerised HIS in hospitals can be measured by the program's functionality and usability. According to the results, the functional construct was important in Jordan. Specifically, the results (Table 4.2) showed that professional healthcare staff found the system friendly and worth the time and effort required to use it. It helped staff make decisions about patient care. They reported that applying the computerised HIS program recommendations to their work improved their ability to use the system.

The use of computerised HIS in Jordan started in 2007. Initially, it had general, basic uses, such as patient admission and discharge and prescriptions. Program use still focuses on its development process, which is supported by previous studies (Al-Yaseen et al., 2010; Fraser & Blaya, 2010).

The results further show that positive technical benefits appeared after the implementation of computerised HIS in Jordanian hospitals. The benefits were clear, because the implementation of the system was new. Previous studies also found similar benefits related to the effects of the technical factor after the implementation of computerised HIS, in both developed and developing countries (Kouroubali, 2003; Mair et al., 2012).

In this study, the effect of the technical factor on the development and implementation of computerised HIS can be categorised into two items. The first is technology. This study found positive effects from the use of computerised HIS, such as new technology in Jordanian hospitals. The technical factor was important in Jordan (see Table 4.2), suggesting that computerised HIS provides reports and precise information that are exactly what healthcare workers need. Computerised HIS are integrated into hospitals' work, and the information available to healthcare workers makes their work easier.

The effect of the functional construct on the development and implementation of computerised HIS can be measured by the functionality and usability of the program (functional factor, items two and four). Specifically, the results (Table 4.2) showed that professional healthcare staff considered the system friendly and worth the time and effort required to use it. It helped them make decisions for patient care. Staff reported that applying the computerised HIS program recommendations to their work improved their ability to use the system. They also reported using the system in their daily work.

For the successful implementation of HIS, the technology must be stable and affordable but not too innovative, and devices must be easy to use. Computers and electrical medical machines must be sufficient, new, must allow healthcare staff to improve their daily work and prompt them to add new ways of working to their practice. This was confirmed in previous studies (Kouroubali, 2003; Mair et al., 2012).

6.2.4.1 The use of computerised HIS.

The study did not find any restrictions on healthcare workers' access to relevant patient pages on the system. When an employee enters their user name and password, they can open patients' pages, within limits. For example, a nurse can view the patient's history, medication orders, laboratory requests and results and other details, but cannot change any information. A nurse can insert nursing notes, send requests to other departments and get a patient's reports, but cannot make changes to other staff contributions.

This study found many uses of computerised HIS in hospitals, such as facilitating healthcare workers' decision-making when designing a patient's treatment, and providing them with all of the information they need in the treatment processes. It also provides all results and reports for all patients, as entered into the system, from admission to discharge, facilitating practice processes for healthcare workers. One participant, the managerial manager of a hospital, said:

> From applying the computerised HIS in hospital, the medical staff can access to patient page; for example, the general physician can open the patient file and check his blood tests or any other laboratory investigation, X-rays, medical reports, and after he enters his order for this patient, also the specialist can access all patient information in his clinics when he wants to see that patient or any other patient.

These findings are confirmed in previous studies (Fraser & Blaya, 2010; Isabalija et al., 2011; Kotter, 2007; Mair et al., 2012).

Participants considered computerised HIS to be functioning well, as they noted positive changes in the quality of healthcare processes after the implementation of the system. For example, before implementation, admission and discharge processes took a lot of time and effort, but after the implementation of the system, both were vastly improved. Computerised HIS made work processes easier for healthcare workers in all departments, making the system worth the time and effort required to use it (Carmine & Daniel, 2007; Mair et al., 2012).

6.2.4.2 The flexibility of computerised HIS.

In this study, the second sub-construct of the effect of the technical factor in the implementation process is the system's flexibility. Access to patient information through the computerised system makes work processes easier, because comprehensive and accurate information can be accessed more quickly. It was also found that computerised HIS guided healthcare workers in their medical procedures and practice. The flexibility of the system improved the quality of the healthcare processes. The findings indicate that the system's implementation processes are flexible, involving a modular system concept, good interoperability and integration with other ICTs and computerised HIS. The system must not be complex overall, because computerised HIS were meant to improve healthcare processes. When computerised HIS are easy to use and able to be fixed, the quality of healthcare processes will increase, confirming the results of earlier studies (Chaudhry et al., 2006; Herrick et al., 2010; Mair et al., 2012).

Functionality focuses on many things, such as comprehensiveness and the ways in which the system can be used. The following things should be available and functional, to allow workers to make decisions about healthcare processes: a balance between new

functionality and stability, healthcare worker training, availability of most patient information in the system, accurate information that improves the decision-making process, cooperation between healthcare workers and adequate human resources. This is supported by previous studies (Bowdith, 2001; Frabotta, 2002; Carmine & Daniel, 2007; Mair et al., 2012). The results also indicate the positive effects of the functional factor on the implementation of computerised HIS in all hospital sectors. The system facilitates healthcare workers' decisions, because such decisions depend on the documentation of patient information. The participation of healthcare workers in the decision-making process during implementation is important. This is because medical decisions will be accurate and fast, as they depend on information available in the system. Correct decision-making regarding diagnosis and treatment will improve healthcare processes, as found in previous studies (Carmine & Daniel, 2007; Mair et al., 2012; Nussbaum, 1998).

6.2.4.3 The updating and development processes of computerised HIS.

The third item of the functional and technical construct is the updating and development process. This factor had a negative effect on the development and implementation of computerised HIS in Jordanian hospitals. As mentioned earlier, an easy means of updating system processes was unavailable, because hospital managers purchased the system from developed countries. They sent some healthcare workers to the manufacturing country for training, and to learn how to use the system. When they returned, they trained other healthcare workers in the use of the system.

In Jordan, the meaning of 'updating processes' to department employees was simply to manage computers and electronic machines when they malfunctioned or stopped working. This is a critical point: management must improve the quality of healthcare processes in the correct way in Jordanian hospitals. In developed countries, hospitals provide a high quality of care, and engage in continuous updating. Updating

processes for computerised HIS are a major technical factor confronting their implementation in both developed and developing countries, because the installation of computerised HIS is more complicated than the installation of software on a regular computer. At some point, hospitals must install new programs. Development must be conducted in small teams with continuous user involvement, sufficient modelling of healthcare processes and use of open standards, as found in previous studies (Chaudhry et al., 2006; Herrick et al., 2010; Mair et al., 2012).

The qualitative results focused on the functional and technical factors together, because these are closely linked in Jordanian hospitals. These factors are the use of computerised HIS; decision-making processes; merging of computerised HIS with healthcare workers' work; the updating processes of computerised HIS; and restrictions on health staff's use of computerised HIS via user names and passwords, in order to ensure the privacy of patient information and improve healthcare process, and to help staff make the correct treatment decisions quickly. These two items help staff merge the computerised HIS with their daily work. All Jordanian hospitals that implemented a computerised HIS saw improvements in the quality of healthcare processes, evident in the fact that some hospitals gained accreditation certificates afterwards. One participant said:

> The implementation of the computerised HIS program enhances the hospital to get to get many international accreditation certificates such as ISO9001 and JCIA. And these certificates encourage people form Jordan or any other countries to come to this hospital for health treatment, because these certificates are good indicators for the high quality of healthcare.

Updating processes were also a problem in the qualitative findings, especially in public sector hospitals, because the implementation of computerised HIS was new in the

developing country. This finding confirms those of previous studies (Carmine & Daniel, 2007; Chow, 2013; Mair et al., 2012; Nussbaum, 1998).

This study found that the cultural factor also affected the implementation and development of computerised HIS, and was important in Jordanian hospitals. Table 4.2 presented these findings, showing that healthcare workers were satisfied with the computerised HIS installed in their departments. The computerised system makes work easier, and improves its quality. They believe that the installation in their hospital was successful.

Two cultural factors affect the sub-construct during the implementation and development of a new system or program. The first is resistance to change, and the second is openness to change. The first factor started with the resistance of healthcare workers to moving from the old, pre-computerisations methods. However, this study detected a low level of resistance to the implementation of computerised HIS (functional factor, item two). This low resistance was because implementation had occurred more than eight years ago, and in that time resistance had almost disappeared. Further, healthcare workers had observed improvement in healthcare processes after implementation.

The results also reported positive effects of the cultural factor on the implementation of computerised HIS in Jordanian hospitals. Working process performance was improved, and they became easier than before the implementation of the system. The most influential cultural factor on the implementation of computerised HIS in hospitals was healthcare workers' resistance to change, confirming the findings of previous studies (Benson, 2002; Brender et al., 2006; Carmine & Daniel, 2007; Isabalija et al., 2011).

The results also indicate the importance of the availability of promoters with a vision. The activity of promoters includes marketing the benefits of the new system and forming support for computerised HIS. Supporting various healthcare workers in their use of the system and the satisfaction of healthcare workers who want to implement the system confirms the findings of previous studies (Carmine & Daniel, 2007; Isabalija et al., 2011; Mair et al., 2012).

The second factor affecting the implementation of computerised HIS is openness to change. This began about two to three years after implementation, at the end of the resistance stage. Healthcare workers gradually changed their opinions, from resistance to acceptance of the system, after they observed its positive effects on their working processes, and the improvement in the quality of healthcare. In this study, the responses of most healthcare workers focused on the second stage, openness to change. As mentioned earlier, implementation started eight years prior to this study, and during the intervening time, resistance to change almost disappeared in most of the Jordanian hospitals that had implemented the system. The study also found that healthcare workers observed the positive effects of the system, because working processes became easier. Managerial staff observed an improvement in the quality of the healthcare processes, which was reflected in the obtainment of international certificates.

Being open to change meant that the new way must be accepted to have improved healthcare processes. Standardised ways must also have been accepted by providers of healthcare processes, aligning individual goals. This idea involves understanding that the implementation of computerised HIS has improved and motivated a change in institutional goals, and that the computerised HIS improved and motivated the change. If healthcare workers begin to accept computerised HIS by understanding its benefits, cultural resistance will disappear, because the major benefits are improved quality of

healthcare for patients and an improvement in the quality of staff work. By understanding that computerised HIS improve hospital processes, they are more likely to succeed in hospitals, confirming the findings of previous studies (Carmine & Daniel, 2007; Heckley, 2004; Isabalija et al., 2011; Mair et al., 2012).

The implementation process curtailed the costs of hospital treatment. One participant, the technical manager of a hospital, said:

> The cost containment process was clear through the time-consuming or decreasing the length of stay period in the hospital. For example, when the patient was admitted to hospital for treatment, and the length of stay of this patient decreased from two weeks to one week, related to rapid decision-making process and related to the general idea that implementing a computerised HIS in the hospital meant a rapid treatment process and decrease the long of stay in hospital, all these things will increase the number of patients they admitted to hospital and increase the financial benefits for the hospital.

The results of this study also indicate that hospitals introduce policies to ensure that they have expert staff in their ICT departments. This study found shortages in Jordanian hospitals of IT departments and IT staff. Staff who are experts in their own fields are responsible for managing computers and electronic machines. Such fields might include computer science or engineering, but not computerised health. Evidence for this was mentioned regarding the technical factor, especially the fact that updating processes for computerised HIS is not available in Jordan. Experts on the system came from the manufacturing country during the implementation period, and left three months afterwards.

This sub-construct was mentioned by a majority of interview participants. The main idea behind it was that the participants agreed with the positive effects of

computerised HIS on their work, and that its use ensured the occurrence of fewer medical errors. For example, a participant from RMS Hospital said:

> One of the most important factors that support applying a computerised HIS in hospital is a decrease in medical errors through applying health information system to checking and rechecking the medical information for the patients before any medical procedure, also because the employee now can see electronically from this system who is the person who did that procedure. After detecting the employee who made this medical error, there is punishment for this person for this medical error and for each employee who makes medical errors for the patients.

In general, legislation must also be appropriate. Therefore, staff who are experts in ICT must also be involved in committees relating to changing legislation and healthcare reforms. This confirms the findings of previous studies (Benson, 2002; Brender et al., 2006; Carmine & Daniel, 2007; Mair et al., 2012).

6.3 Benefits of the Computerised HIS Construct

The implementation of any new programme in an institution is done to obtain new benefits and to develop work processes. The aim of implementing computerised HIS is to improve the quality of healthcare processes. Four major benefits were observed in the previous studies, after the implementation of computerised HIS in developed and developing countries. According to Isabalija et al. (2011) and Mishra (2007), these benefits are:

1. Improvement in the quality of healthcare processes.
2. Improvement in the efficiency and effectiveness of healthcare processes.
3. Improvement in the safety of healthcare processes for patients and healthcare workers.
4. Improvement in the cost containment of healthcare processes.

The results of this study identified the benefits of computerised HIS as falling into four major sub-constructs. These explore the benefits of computerised HIS, from their implementation in Jordanian hospitals, and are an improvement in the quality of patient care; improved decision-making; improved cooperation and contact processes and improved patient security. These ideas are explored under two categories, clinical and organisational benefits.

The findings of this study indicate that the clinical benefits of such a system are focused in five main benefits. The first clinical benefit of the implementation of computerised HIS in Jordanian hospitals was the facilitation of the patient healthcare process. This major benefit was detected in all hospitals, and was especially clear when pre- and post-implementation healthcare processes were compared. For example, before implementation, healthcare processes took a long time, from admission to discharge. Long hospital stays resulted as a consequence of slow diagnosis, itself the result of insufficient medical information and delays in collecting and relaying information, such as the late collection of laboratory tests, medical reports or consultations, and the necessity of searching through old paper files. It took a long time to diagnose a disease, so treatment was started late.

In this study, after the implementation of computerised HIS, the length of hospital stay reduced as the information collection process reduced. The decision-making process related to patient diagnosis took less time, and treatment started earlier. When medical staff detected a disease more quickly, treatment started earlier and its length decreased. Resultantly, the length of hospital stays declined. The quality of healthcare processes improved, and the financial cost of treatment declined, aiding cost containment in the hospital budget.

The benefits found in the qualitative part of this study are the same as those in the quantitative part, and also the same as those identified in other studies. As mentioned in the methodology section of this study, qualitative methods were used to identify new benefits not mentioned in the quantitative section or in previous studies. In this study, the implementation of computerised HIS obtained many benefits and developed healthcare processes.

6.3.1 Improving the quality of healthcare processes.

There is clear evidence of improved healthcare in hospitals that have implemented this system, in both developed and developing countries. The results of this study showed many benefits, eight years after the implementation of computerised HIS in Jordanian hospitals. The major benefit was the improved quality of healthcare processes for patients. Participants noted these benefits after comparing the quality of healthcare processes before and after implementation. The improvements included increased electronic documentation for patients in all departments, which staff could find at any time; continuity of care in the treatment of patients readmitted to hospital; the collection of tests and investigations in a short time; and a decrease in the occurrence of medical errors and mistakes.

Participants' views on the use of computerised HIS in hospitals were that it facilitates healthcare and treatment processes for patients in many ways. For example, healthcare staff can access a patient's information and medical references at any time and from any department. The results of this study indicate that without the use of computerised HIS, this process can consume treatment time. Treatment costs can also be reduced. All of these changes improve the quality of the healthcare process, which confirms the findings of previous studies (Amin et al., 2011; Buntin et al., 2011;

Chaudhry et al., 2006). There is clear evidence of the improved quality of healthcare in both developed and developing countries that implement computerised HIS in hospitals.

Many benefits could be observed five years after the implementation of computerised HIS. The most important benefit was the improved quality of healthcare processes for patients. These benefits were observed after comparing the quality of healthcare processes before and after the implementation of the system. The improvements were summarised by the head nurse of a hospital as:

1. Increased electronic documentation for patients in all hospital departments, which can be accessed at any time.
2. Continuity of treatment processes for patients readmitted to hospital.
3. Collection of all tests and investigations in a short time.
4. Decreased medical errors.

6.3.2 Decision-making.

The second clinical benefit after the implementation of computerised HIS in Jordanian hospitals identified in this study was improved processes for healthcare workers, such as doctors and nurses. The most important aspect of the healthcare process is diagnosis of the patient, and this became easier and took less time after the implementation of the computerised system. Diagnosis requires the collection of all patient information, including old files, laboratory tests and old and new medical reports. The collection process takes a long time. This study found that after the implementation of computerised HIS in Jordanian hospitals, the collection of patient information takes less time, as staff can refer directly to the system. Diagnosis is performed more easily and clearly, and healthcare workers can begin the medical treatment earlier.

This study indicates that the system has improved cost containment for health services in Jordanian hospitals, and has improved the quality of healthcare processes.

Computerised HIS, which is now used by most hospitals in developing and developed countries, is essential to improving the quality of healthcare, through supporting healthcare workers' decision-making and treatment processes, and improving healthcare development policies, confirming the findings of previous studies (Buntin et al., 2011; Chaudhry et al., 2006; Fraser & Blaya, 2010).

This study also found that decision-making processes in hospitals occurred in two steps. The first is data-led: the need for the computerised system to contain data on the determinants of health, and the need for the cost containment of healthcare procedures and health interventions. The second is action-led: the required actions taken through the HIS. These two steps allow suitable medical decision-making by healthcare workers and improve the level of healthcare quality in hospitals, confirming the findings of previous studies (Buntin et al., 2011; Chaudhry et al., 2006; Panerai, 2000).

The second sub-construct under the benefits of implementing computerised HIS in hospitals was the decision-making theme. The findings indicate that the decision-making theme enhances patient healthcare processes. The most important element of the treatment process is decision-making, because medical healthcare staff cannot begin a treatment process before correct diagnosis. This study found that the implementation of computerised HIS improved the diagnostic process in many ways, such as speeding up the process by enabling the collection of patient history from older electronic files, or acquiring laboratory tests and medical investigations quicker, resulting in starting and finishing treatments sooner. The study also found that this process increases productivity in hospitals, with medical treatments finished in a shorter time. The rapid decision-making processes of diagnosis and treatment is one of the most important factors in the implementation of computerised HIS in hospitals. This is clear when the use of electronic patient files is compared to the use of paper files.

This study also found that using computerised HIS supports healthcare staff, such as doctors, nurses and pharmacists, allowing them to make suitable and correct medical decisions for the patient, as they depend on the electronic documentation of accurate and sufficient information. The implementation of computerised HIS facilitates healthcare processes and improves their quality. This is clear when patient processes before the implementation of the system are compared to process after. For example, before implementation, patients' hospital stays were long, from admission to discharge. Longer stays in hospital were related to the time taken to diagnose. Further, when treatment starts earlier, it takes less time. This increases hospital productivity. As one participant said:

> The high speed of completing the medical treatment process through the rapid decision-making-process of diagnosing and treatment of a patient's disease was one of the most important factors in implementation of a computerised HIS program in the hospital. This change was clear when comparing this situation of using electronic patient files with the same situation before the implementation this program by using paper patient files. Also applying the computerised HIS in hospital enhanced all medical staff such as doctors, nurses, and pharmacists in suitable medical decision-making for the patients, depending on the accurate and sufficient information for the patients that documented electronically in the patients file in the system.

After the implementation of computerised HIS, patients' hospital stays decreased, due to quick decision-making, diagnosis and treatment. Healthcare processes improved, decreasing the financial costs of treatment and containing costs for the hospital. All of these changes improved efficiency, effectiveness and quality of healthcare processes, confirming the findings of earlier studies (Amin et al., 2011; Buntin et al., 2011; Chaudhry et al., 2006).

6.3.3 Cooperation and contact processes.

The third clinical benefit identified after the implementation of computerised HIS in Jordanian hospitals was that such systems help coordinate all healthcare workers in hospitals. The findings of this study indicate that contact between healthcare workers became easier after the implementation of computerised HIS. For example, medical ward staff and laboratory staff interact through the system when test samples are sent to the laboratory, and when results appear. Laboratory staff directly enter the results into the patients' files in the system, at which time the medical staff start a new order action after checking the results. The results also indicate coordination in the electronic appointments schedule. In these ways, treatment processes are less time consuming, and the quality of healthcare increases for patients and healthcare workers. Implementation of computerised HIS has facilitated coordination between healthcare workers, improving patient treatment processes. For example, healthcare workers can access patient and medical information through this system from any department, using their user name and password, so the system allows the cost containment of the treatment process. Such changes have improved the quality of healthcare processes, confirming the results of previous studies (Buntin et al., 2011; Chaudhry et al., 2006).

The third sub-construct under the benefits of implementation is cooperation and contact between professional healthcare staff, regarded as one of the major benefits of such a system. The findings of this study indicate that contact was weak and indirect between healthcare staff before the implementation of the system. Afterwards, contact became more direct and was under continual managerial supervision. The study also found that the electronic documentation of contact regarding medical orders enhanced patient treatment. All of these benefits improved the quality of healthcare processes for patients and healthcare staff. As the head of a nursing department said:

> The contact between medical staff in hospital became easier after implementation of the computerised HIS program in the hospital. The physician in the hospital can find the patient file from any computer in the hospital by using a specific user name and specific password for each member of the healthcare workers, and he can insert the medical order into the system after he sees the patient's file and new investigations or test; if the patient needs an urgent order, then this order will appear directly in the ward of that patient. Also when the physician or nurse or any other healthcare staff need any information for their patient, they can get it in a short period after entering the request for that information to any department in the hospital. This benefit enhances the medical staff's working together as a team in the hospital.

The results also found that the implementation of computerised HIS helps coordination between healthcare workers, as much contact occurs through this system.

The fourth clinical benefit identified is the use of computerised HIS to enter and save patients' medical information, such as daily nursing notes, medical orders and clinical biochemical laboratory analyses, and to obtain this information when investigating treatment procedures. All such uses of the system developed and improved the quality of healthcare processes in the Jordanian hospitals that had implemented it. After the implementation of computerised HIS, the positive effects of improved efficiency and effectiveness of healthcare processes were detected. Entering and saving patients' medical information facilitated healthcare processes by speeding up treatment processes. All of these benefits improved the quality of healthcare processes, as identified in previous studies (Buntin et al., 2011; Mair et al., 2012).

The fifth and final clinical benefit identified was the answering of questions of a general medical nature. Healthcare workers can find the medical information required for

healthcare processes, such as treatment, signs and symptoms of a disease, complications or any other information. Such information is available from new medical articles and research from the Health Research Department of the MOH. For example, healthcare workers can check for new medical information on chronic diseases, such as treatment processes or complications. If healthcare workers learn of a new medication, then through the system they can also find its actions and side effects before use. The clinical benefits of providing healthcare workers with medical knowledge and information include improvement of the quality of healthcare processes. This study's findings suggest that the use of computerised HIS in Jordanian hospitals has improved healthcare and treatment processes for patients through healthcare workers' obtainment of answers to medical questions via the system. In the Jordanian hospitals that have implemented a computerised HIS, workers can now access medical information at any time and in any department, through medical websites such as the hospital personnel website. This facilitates access to necessary information on treatment processes. Further, this study found that the benefits improved the quality of healthcare processes through reducing the time spent on treatment, as well as its costs, confirming the findings of previous studies (Amin et al., 2011; Buntin et al., 2011).

The second benefits category of implementation is organisational benefits. This study found that the organisational benefits of implementation include seven major components. The first organisational benefit was the continuity of patient care processes. This results from patient information being saved in the system under the medical number and name of the patient. When patients with chronic diseases are readmitted to hospital after a long time, healthcare workers can find all previous information by entering the medical number or patient name into the system. The electronic patient file will open directly. The information of a newly-admitted patient is also saved in the system, under

the patient's medical number. This process improves a patient's health status and increases the quality of the healthcare process, as mentioned in previous studies (Amin et al., 2011; Buntin et al., 2011; Chaudhry et al., 2006).

The second organisational benefit was that the implementation of computerised HIS facilitated communication between healthcare workers in all hospital departments, and in other hospitals. This enhanced the healthcare and treatment processes in Jordanian hospitals. There are many aspects to this facilitation, such as quick and easy access to patient information via electronic files. The decision-making processes for patient treatment are also shorter, allowing cost containment. This study found that all of these changes improved healthcare and treatment processes, and improved the quality of healthcare processes in hospitals. The best example of such a benefit is telemedicine, a rapidly developing application whereby clinical medical information is transferred between healthcare workers in hospital departments or between hospitals and medical institutions, via the Internet, telephone or other networks, through a consultation process. These findings confirm those of previous studies (Mishra, 2007; Isabalija et al., 2011).

The use of computerised HIS facilitated healthcare and treatment processes for patients in many ways. For example, doctors or other medical staff can access patient information and medical references at any time and in any department via their user name and password. This process consumes less time and reduces treatment costs, as found in the results of this study. These changes improve healthcare processes, as supported by previous studies (Amin et al., 2011; Buntin et al., 2011; Chaudhry et al., 2006).

As mentioned in many previous studies, the major benefit of the implementation of computerised HIS is improved healthcare and treatment processes. This study found many benefits from the implementation of this system, and together, these benefits improve the effectiveness and efficiency of healthcare processes. The best example of

these benefits working together is the decision-making process of diagnosis. This depends on access to patient information in the system, and making the right medical decisions, enhancing, speeding up and improving healthcare and treatment processes. Computerised HIS, now used in most hospitals, is essential to improving the quality of healthcare through supporting staff decision-making in treatment processes, and improving health policies that enhance healthcare development, confirming the findings of previous studies (Buntin et al., 2011; Chaudhry et al., 2006; Panerai, 2000).

The third organisational benefit identified was that computerised HIS provide high quality health and medical information. The findings of the study indicate that the system provides clear, comprehensive, significant and accurate information to healthcare workers on patients. The information is documented electronically. Laboratory results appear in the system directly when they appear in the laboratory. If the results are normal, they will be documented in the patient file; if they are abnormal, this is also documented and an alert is immediately sent to the healthcare workers responsible for the patient. Further, the results show that patient information entered into the system is accurate, because healthcare workers are supervised when entering it, and if mistakes occur there are punishments or penalties for the worker who made the error. The system can detect the employee responsible for the error through the user name.

The high quality of health information resulting from the implementation was one of many benefits improving the quality of healthcare processes in Jordanian hospitals. The benefits started appearing slowly, until the system was completely integrated. This study found that the system of making patient appointments electronically was another benefit of computerised HIS. The improved quality of healthcare processes and the containment of patient treatment costs are related to a decrease in patient waiting time, confirming the results of previous studies (Bradley & Joseph, 2008; Fischer et al., 2008).

6.3.4 Patient security.

The findings of this study reported that patient information security is one of the clearest results of implementing computerised HIS. The patient considers their information private, and the system must maintain its privacy and security from other people, especially in the case of a critical diagnosis. Before the implementation of computerised HIS, patient information was contained in paper files, and any medical staff could see all files. This study found that after the implementation of computerised HIS, all except responsible healthcare staff are prevented from seeing patient files. Medical staff do not give patient information to anyone, because this information is private. The system detects and electronically documents healthcare staff who open electronic patient files; this supervision supports patient security. This policy of patient information security began when computerised HIS were first implemented in hospitals.

The fourth organisational benefit found in this study was that individuality and private care for all patients was achieved. Patient security is an important patient right. After the implementation of computerised HIS, patient security policies were instated in Jordanian hospitals. A criterion for quality of healthcare processes in hospitals is that healthcare workers must keep patients' private case information secret from all other persons, such as the relatives of the patient, especially in developing countries, such as Jordan. The only people allowed access to patient medical information are healthcare workers, via their user names and passwords. The findings of this study reported that the implementation of computerised HIS increased the quality of healthcare processes in hospitals, by achieving private patient care, confirming previous studies (Amin et al., 2011). Through the use of employee user names and passwords, employees can only open the pages specific to their responsibilities. For example, a medical records employee can see information such as demographic data, diagnosis and health insurance information. A

physician or other healthcare worker can access patient and medical information concurrently, from any hospital department.

The fifth organisational benefit identified in this study was the improvement and development of health research processes. Scientific health research and health projects in hospitals are very important, because research detects the major health problems facing the health sector in Jordan. This study found that after implementing computerised HIS, the detection of major health problems became easier. After detection, managerial medical staff can begin to solve and control for medical problems. Healthcare workers with access to new research via the Internet engage in enhanced treatment processes. Significant development of scientific health research and projects occurred in Jordan after the implementation of computerised HIS. This study found that this development was related to the ease of data collection, as researchers could collect data quicker than before HIS implementation. Jordanian researchers found that the required data is saved in a systematic way, and that it is accurate and comprehensive. This affects the way they use statistical information to detect disease, learn about new medications for chronic disease and new medical technology.

Further, this study indicates that scientific research is very important in the health field, especially in the study of diseases and aspects related to patient health status in hospitals. When comparing this benefit before and after the implementation of computerised HIS, the two processes are clearly different. Before implementation, the collection of data from patient files was very difficult because it took a long time, and information was insufficient and inaccurate. It was also difficult to return to patients' files to check the accuracy of information. This study found that after the implementation of a computerised HIS, data collection became easier, as information collection occurs automatically. Healthcare researchers only need a short time to collect and check the

information's accuracy. The implementation of computerised HIS facilitate the research process, and researchers can find and check health information simply, using hospital systems.

All of these benefits of computerised HIS and the Internet improve the quality of healthcare processes. For example, when conducting research utilising comprehensive data on medication, researchers find that many patients provide information on which drug is best. They can also detect the signs and symptoms of new drugs for chronic diseases, confirming the findings of previous studies (Chaudhry et al., 2006; Herrick et al., 2010; Mair et al., 2012).

The sixth organisational benefit identified in this study was the review of patients' problems, as patients are given medical reports from the computerised HIS, regarding their status. The results indicate that this benefit increases patient satisfaction with the healthcare process, because it decreases waiting time and the effort required to obtain medical reports. The implementation of computerised HIS resulted in many positive effects on the efficiency and effectiveness of healthcare and treatment processes, such as patients' satisfaction with healthcare and treatment processes. These systems detect the responsibility of each employee, and reduce the time spent reviewing patient information (such as history and laboratory tests), or obtaining medical results. This confirms the findings of previous studies (Buntin et al., 2011; Chaudhry et al., 2006; Mair et al., 2012).

The seventh organisational benefit identified was the ability to use computerised HIS to follow patient results from a particular test or investigation over time, by collecting patient information for various medical needs. One benefit was the ability to follow specific test results over a continuous period, when they needed systematic testing and reviewing. The system automatically provides documentation for procedures that need systematic reviewing over long periods. This benefit facilitates healthcare and

treatment processes. The literature reviewing the use of computerised HIS documents positive effects from following patient information over a short time. These studies have assessed the implementation process and detected many improvements and positive effects on healthcare and treatment processes, supporting medical decisions on care and treatment processes. This confirms the findings of previous studies (Buntin et al., 2011; Mair et al., 2012).

This study reported many benefits from the implementation of computerised HIS, among them the health information and statistical data that can be used in health research. For example, researchers can study the prevalence or incidence of a disease, or study new diseases in all hospitals over a specific period. The program automatically generates an annual report on all statistical information required for the annual statistical reports. After the implementation of a computerised HIS, the detection of major health problems also became easier, allowing managerial staff to control for such problems. Also, when conducting research utilising comprehensive data on medication required for treatment, researchers find that many patients will provide information on the most appropriate drugs for particular diseases. Healthcare workers can also access new research via the Internet and this system, to enhance treatment processes. The use of statistical information to detect diseases, learning about new medication for chronic diseases and the use of technology and new electronic medical machines are all benefits of computerised HIS. They improve the quality of healthcare, confirming the findings of previous studies (Chaudhry et al., 2006; Herrick et al., 2010; Mair et al., 2012). These benefits were also evident in the qualitative results. For example, the implementation of computerised HIS facilitates the research process, so researchers can find and check health information simply, using these systems. As one participant, the manager of a hospital's IT department, stated:

> There are many benefits from an implemented computerised HIS program in hospital; one of these benefits is the health information and statistical data used in the health research process, such as the number of cases for each disease in all departments in the hospital through a specific period. For example, the researcher can calculate the number of hypertension patients in an easy way, in order to publish a paper about the prevalence and incidence of hypertension in the last year. So we can collect this information in an easy way and a short time by using this program in hospital. Also, this program automatically, at the end of each year, gives us an annual report for all statistical information we need to put in annual statistical reports book

The other findings were that the benefits were significantly affected by the age and length of work experience of the participants. Those aged between 25 and 29 were most likely to believe that the benefits were important (see Table 4.6), as did those with more than 16 years' experience.

6.4 Barriers to the Implementation of Computerised HIS

In this study, the barriers identified via the qualitative results were the same as the barriers identified in other studies. As mentioned in the methodology section, the qualitative method was intended to explore new benefits or barriers not mentioned in the results of the quantitative method, or in previous studies. The installation of computerised HIS in Jordanian hospitals faced three major barriers during the three stages of implementation. This study reviewed literature in which major barriers facing the implementation of computerised HIS in hospitals was detected. The findings of this study reported that the implementation of computerised HIS results in many benefits and barriers that affect the development of healthcare processes in hospitals. The implementation of any such program will face some barriers. The barriers found in this

study include updating processes, cultural factors and acceptance of new systems by older employees. The barriers to implementation, using the qualitative method, are collected into three sub-constructs:

1. Updating processes of computerised HIS.
2. Shortage of equipment for computerised HIS.
3. Resistance to implementation of computerised HIS.

6.4.1 Updating processes of computerised HIS construct.

The computerised system used in any health institution or hospital needs updating annually, due to program developments. The findings of this study indicate that computerised HIS must be updated yearly to achieve an accreditation certificate for the improvement of healthcare quality in hospitals. This study found that in Jordanian hospitals, the main barrier to the implementation of computerised HIS was the updating processes. Programs have been operating in the hospitals for five years or more without being updated, because there is a belief that 'updating processes' are simply meant to manage program malfunctions. This barrier derives from the fact that hospitals do not have the financial means to update programs. Many Jordanian hospitals are still working with old computerised HIS installed three to five years earlier. The managerial manager of one hospital said:

> The updating process for the computerised HIS program in hospital is a continuous process. This means that for any problem happening in the program in any department of hospital, the manager of this department makes direct contact with the information technology department of the hospital to come suddenly to manage this problem. Also, the information technology staff in hospital are very cooperative to solve and manage any problem in the program. The hospital in this

period looked to implement a new program, because the implemented program had started more than ten years ago.

The main goal of updating computerised HIS is to further develop the system with the latest technology, and improve the quality of healthcare processes. Updating is a continuous process. When problems arise with the program in any department, the manager directly contacts the IT department, who will manage the problem. Hospital IT staff are adept at solving and managing any problems with the program. However, this study found that hospitals look forward to implementing new programs, which first appeared more than ten years earlier.

The results of this study also indicate that updating processes are a barrier to the implementation of computerised HIS and new technology associated with the system in both developed and developing countries, because the installation of computerised HIS is complicated. It requires specialists and expert staff, and needs to be updated at least every two years. Sometimes, hospitals simply install new programs when the previous system gets old. This confirms the findings of previous studies (Chaudhry et al., 2006; Herrick et al., 2010; Mair et al., 2012). This study also found that incomplete implementation and inadequate maintenance of computerised HIS prevent the self-organisation of healthcare workers, again confirming earlier findings (Kouroubali, 2003; Mair et al., 2012).

6.4.2 Shortage of equipment for computerised HIS.

The findings of this study reported that computerised HIS requires equipment such as computers, printers and other electronic devices in order to function correctly. In Jordanian hospitals there is a shortage of staff responsible for the management of the program, and a shortage of computers, attributed to hospitals' insufficient budgets. The study also found that the number of IT staff in hospitals is not enough to meet hospital needs, as they only work the morning shift.

This study found that an insufficient number of computers is the major problem facing hospitals in the implementation of computerised HIS. For example, each ward or station has just one computer. The findings also found that if the ward computer stops working, the electronic contacts and documentation will stop until IT staff can manage the. If a new computer is required, an urgent request must be sent to the hospital's managerial department. This takes a long time, and electronic documentation and contacts cease in that ward until a new computer is brought in.

This barrier stems from the high cost of implementing computerised HIS, which may be the largest problem with this system. For example, when using an electronic prescription to reduce adverse drug events, if the underwritten financial costs of implementation are less than the real financial costs, implementation will fail, confirming the findings of previous studies (Bradley & Joseph, 2008; Lyons et al., 2005; Mair et al., 2012). This study found that the number of computers in hospital departments—often only one per ward—is insufficient to meet healthcare workers' work processes. For example, there was just one computer in a male surgical ward in the university sector, with more than 30 patients, at least five registered nurses and two physicians. All healthcare workers use the computer to access or enter patient information, but the information entered is insufficient, because there are not enough computers or enough time for all patient information to be inserted. Thus, only the most important information is entered, which will affect the patient's treatment, and be detrimental to the improvement of the quality of healthcare processes. A solution has been for managers to focus on paper files. For example, the manager of a hospital's IT department said:

> From the problem that faced hospital in implementation the computerised HIS was the insufficient of the number of computers in the hospital, for example, each ward or station there is just one computer, this the major problem faced the

> hospital after implemented this program, so if the ward computer not functioning or stopped working the electronic contact and documentation will be stopped until the information technology staff manage this problem and if the computer not work and we need new computer we need to make urgent request to managerial department of hospital to buy new computer and this process need long period and the electronic documentation and contact will be stopped until we bring new computer. Also the numbers of information technology staff in hospital not enough to make controls for these barriers, because the information technology staffs working just in morning shifts.

This study also found that the computer shortage in Jordanian hospitals was related to financial problems and the health sector's low budget, especially in government-sector hospitals. Hospitals are unable to purchase sufficient computers, so only procure the minimum required. The most significant result of this barrier is the failure of the system, which means that when computers stop working, it is difficult to access patient information. Therefore, financial restrictions are considered a major problem for the implementation of computerised HIS in Jordanian hospitals. The high costs of correct implementation, income inequality and inadequate resources also appeared in the results of previous studies (Chinnock, 2004; Oak, 2007).

6.4.3 Resistance to the implementation of computerised HIS.

This study found that the implementation of new computerised programs faces resistance at the beginning, as healthcare workers are familiar with old programs, which are easy for them. Such resistance will decrease and disappear in time if the program is implemented correctly. This study found that at the beginning, implementation was strongly resisted by older staff. This took a long time to decrease, and did not completely disappear. This was in addition to other barriers still facing the implementation of

computerised HIS in Jordanian hospitals. This study also found that the major barrier to training was the unavailability of expert, qualified staff to educate other healthcare workers in the correct usage of the system, and about the major skills required. The study also found that hospitals do not have a policy of training new healthcare staff in the use of computerised HIS. The most significant barrier facing the implementation of the system is the response of staff to new technology. Some have responded without proper training in how to improve the efficiency of healthcare processes, and some just use the technology and computers to search the Internet. Some do not use it at all because they did not receive adequate training, confirming the findings of previous studies (Braa et al., 2004; Kouroubali, 2003; Mair et al., 2012).

This study found that some older healthcare workers are unwilling to use computerised HIS because, with more than 20 years' experience, they are accustomed to using paper files. It is difficult for them to learn new programs, acquire a new learning style and undertake training courses. This problem began when the system was first implemented, because trained staff only learnt the basic aspects of the system; for example, how to enter information using the user name and password. They also learnt how to enter basic information, such as patients' demographic data and daily notes. Training was a problem for all healthcare workers, because there was no schedule for the training of existing or new healthcare workers. New healthcare workers were trained simply by working with older, more expert healthcare workers, learning from them how to use the system. The study found there was no systematic way of training new healthcare workers, because they learnt just a few skills required to use the system. Nor were older healthcare workers completely qualified to use the system, as they only had basic skills. This traditional way of teaching negatively affected the healthcare process.

This study found that the resistance to change was related to the lack of training in the use of the new system. Before its implementation, the MOH sent a small group of employees to developed countries to be educated, for around three months. These healthcare workers were from the first hospital to implement computerised HIS. Afterwards, they returned to Jordan and started to use the system. During this period, workers learnt the basic uses of the system, and educated other workers on the correct use of the system.

In developing countries, studies have found that lack of training and supervision are some of the most important barriers to the implementation and development of computerised HIS, because they result in a shortage of appropriate means of collecting information, coupled with a lack of worker skills. For example, existing information is abnormal because it is input into computerised HIS for different reports, and health facilities have not discovered the problem. However, supervising health managers did not observe the collection of the necessary information, confirming the findings of previous studies (Braa et al., 2004; Kimaro & Twaakyondo, 2005; Mair et al., 2012). For this barrier, one participant, the head of a nursing department, said:

> Among the barriers and issues that faced the implementation of a computerised HIS in the hospital was the unwillingness of older staff, the old specialists and old nurses from the staff whose experience in the hospital is more than twenty years. They are accustomed to paper patient files, and also, related to their cultural thinking; it is difficult to learn a new program, needing a new learning style and training course.

This study reported a lack of appropriate human resource strategies in two respects. The first was the lack of healthcare workers' skills. Second was the insufficient training time and practice for healthcare workers. Healthcare staff collect a lot of routine

information for their superiors, rather than using this information in their work. Training time is not sufficient: it only occurred once, if at all, and was not followed up, which is ineffective and unsuitable for healthcare staff. The lack of appropriate strategies wastes human resources and results in the absence of mechanisms to ensure sustainability. These findings were found in previous studies (Kimaro, 2006).

6.5 Conclusion

The results of this study were presented in two ways, according to the data collection methods that produced quantitative and qualitative results. The quantitative results addressed three major issues:

1. The factors promoting or hindering the development and implementation of computerised HIS in Jordan, a developing country.
2. The benefits of implementing computerised HIS in Jordanian hospitals.
3. The barriers facing the implementation and development of computerised HIS in Jordanian hospitals.

The qualitative approach addressed new factors, benefits or barriers from the implementation of computerised HIS in Jordanian hospitals not mentioned in the quantitative methods. The qualitative results were the same as the quantitative results, but the barriers to implementation are reported only in the qualitative results. A summary of the study results are arranged under the three major titles, listed above.

The factors promoting or hindering the development and implementation of a computerised HIS were collected into six major factors, as mentioned in the study instrument (questionnaire), and each of these major factors covered more than two ideas, summarised as items. These main factors are the organisational, managerial, functional, technical, cultural, and legal factors.

First is the organisational factor. The effect of this factor on the implementation of computerised HIS was completely positive, in that it improved healthcare processes and the quality of healthcare in all sub-organisational factors. These involved an improvement in the quality of daily work for patients and healthcare workers in all Jordanian hospitals that had implemented this system, enhanced accuracy of patient data and medical information, enhanced cooperation between healthcare workers in all hospital departments and easier healthcare processes for healthcare workers.

The second factor is the functional factor. The effects of this factor on the implementation and development of computerised HIS were found in four items, all of which had a positive effect on the improvement and quality of healthcare processes. Positive effects included improved decision-making processes during treatment, a decrease in costs and time spent on healthcare practices and procedures and increased work satisfaction for healthcare workers.

The third is the managerial factor. This was covered by four items, most of which had a positive effect on the improvement of healthcare processes and the quality of healthcare, while two items had a negative effect on the development and implementation of computerised HIS. The positive effects of the managerial factor were clear in the items, such as the way that computerised HIS helped healthcare workers easily access patient information at any time from any department, and the fact that the length of time during which healthcare workers used the system for medical documentation was acceptable. Also, older healthcare workers helped newer workers use the system correctly way, and the professional healthcare team was certain of the reliability of the data documented. The negative effects of the managerial factor on the development and implementation of computerised HIS were found in two items related to defects in the role of managers in Jordan’s health sector. The first effect was a shortage of computers in hospitals, and the

second was the short training period and lack of training in the use of computerised HIS for new staff.

The fourth factor is the technical factor. The effect of this factor on the implementation and development of computerised HIS was found in two items, seven of which had a positive effect on the improvement and quality of healthcare processes, while one had a negative effect on the development and implementation of computerised HIS. The positive effects included the fact that the system provided precise health information, output health information and specific medical reports, and provided sufficient medical information and data. The technical factor also enhanced access to health information and made the work of healthcare professionals easier. All of these positive effects occurred after the implementation of computerised HIS in all Jordanian health sectors. The negative effect of the technical factor was the updating process. Computerised HIS were implemented in Jordan's four health sectors more than five years ago and had not been updated, due to low hospital budgets and financial problems.

The fifth factor is the cultural factor, which had a positive effect on healthcare processes. When computerised HIS were first implemented in Jordanian hospitals, healthcare workers resisted the system. However, two years after implementation the resistance had disappeared, as healthcare workers became familiar with the system and observed its positive effects on healthcare processes for both patients and themselves.

The sixth factor is the legal factor, which had a positive effect on healthcare processes. After the implementation of computerised HIS, when policies and penalties began to be applied, the commitment of healthcare professionals increased. This factor improved the quality of healthcare processes in Jordanian hospitals.

The benefits of the implementation of computerised HIS were clear three years afterwards. These benefits were classified into two sections: the clinical benefits category

and the organisational benefits category. The clinical benefits following implementation were categorised into five benefits:

1. Computerised HIS facilitate decision-making in the patient care process.
2. Computerised HIS facilitate the patient care process.
3. Computerised HIS help coordinate patient care.
4. Computerised HIS allow staff to enter daily notes, order clinical biochemical laboratory analyses and obtain information on investigations or treatment procedures.
5. Computerised HIS answer questions on general medical knowledge (e.g., treatment, symptoms and complications).

The organisational benefits issues after implementation are categorised into seven benefits:

1. Computerised HIS allow continuity in patient care.
2. Computerised HIS facilitate communication between healthcare teams in hospital departments.
3. Computerised HIS provide high quality information.
4. Computerised HIS achieve individualised care.
5. Computerised HIS improve research and development.
6. Computerised HIS can be used to review patients' problems and also give general, written medical information to patients.
7. Computerised HIS can be used to enter daily notes, order clinical biochemical laboratory analyses and obtain information on investigations or treatment procedures.

The barriers to the implementation of computerised HIS are classified into three groups:

1. The updating process of computerised HIS.

2. A shortage of equipment for computerised HIS.
3. Resistance to implementation of computerised HIS.

This chapter has presented and discussed the integrated results of this mixed-methods research. The results indicated that the quantitative and qualitative studies were well connected. Some qualitative findings provided further clarification and explanation of the quantitative results. Moreover, the findings on work experience provided insight into how health staff cope with implementation and development of computerised HIS.

6.5.1 Limitations of the study.

This study is only a preliminary step in the investigation of the development and implementation of computerised HIS in Jordanian hospitals. The study had some limitations.

The results of the current study may not be generalised to all developing countries, because it was conducted only in Jordan so the outcomes are limited to Jordanian hospitals, particularly the four hospital sectors included in the study. Further study in other Jordanian hospitals and in other countries is required.

The study was also limited by the use of self-report measures. In surveys using self-report measures, there is always the potential for bias because of the tendency of responders to endorse what they perceive as socially desirable. Self-report bias is also possible. It is possible that those more interested in HIS may have been more likely to complete a questionnaire or volunteer to be interviewed.

6.5.2 Recommendations.

Further research in other governorates in Jordan is needed, in order to confirm the results of this study. The following actions are recommended for the study of the development and implementation of computerised HIS in Jordan.

6.5.2.1 Training and feedback.

The training of healthcare workers in the use of computerised HIS should be implemented. If possible, the curriculum of health training institutions should include data analysis and presentation techniques. An orientation programme should be developed for new healthcare workers, in order to provide them with a better understanding of the implementation process of computerised HIS, and to help them identify factors for improvement of the system's implementation. An effective training programme for healthcare workers should be developed and implemented in order to increase their awareness of the importance of computerised HIS in enhancing the performance of healthcare processes.

6.5.2.2 Updating processes of computerised HIS.

The updating processes of computerised HIS should concentrate on privacy, security and confidentiality, to prevent persons from illegally accessing patient health information. Such an updating process will improve the quality of health in Jordanian hospitals. New strategies for the enhancement and implementation of computerised HIS in Jordanian hospitals should also be developed and put into place. Priorities should also be established to improve the quality of healthcare processes, according to the improvement level necessary for this process.

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Appendices

Appendix A

The research survey was based on literature related to the factors promoting or hindering the development and implementation of computerised HIS in Jordan, a developing country.

The Research Survey

Section B: Organisational factor.

The following items refer to the organisational factor of the computerised health information system (HIS), and support that you receive in its use. Please indicate your level of agreement with each item.

The items:	SA	A	NA/ND	DA	SD
The suggestions I make about the computerised HIS are taken into account	1	2	3	4	5
The changes introduced via the computerised HIS have importance for my daily work	1	2	3	4	5
The computerised HIS is accurate	1	2	3	4	5
The health information program improves the quality of work	1	2	3	4	5
The attitude of the personnel in the health informatics department is cooperative	1	2	3	4	5
I find all the information I need	1	2	3	4	5
The information is comprehensive	1	2	3	4	5
Data I register is important for the care of patients	1	2	3	4	5
The computerised HIS makes my work easier	1	2	3	4	5

Notes: SA = strongly agree; A = agree; NA/ND = Neither agree/Nor disagree; D = disagree; SD = strongly disagree

Section C: Managerial factor

The following items refer to the managerial factor of the computerised HIS. Please indicate your level of agreement with each item.

The items:	SA	A	NA/ND	DA	SD
The computerised HIS is easy to use	1	2	3	4	5
I have access to the information where I need it	1	2	3	4	5
I have access to the information when I need it	1	2	3	4	5
The number of computers is adequate	1	2	3	4	5
I help other health staff use the computerised HIS in practice	1	2	3	4	5
The time I take for documentation is acceptable	1	2	3	4	5
I am certain about the reliability of the data documented	1	2	3	4	5
I have received adequate HIS training	1	2	3	4	5

Notes: SA = strongly agree; A = agree; NA/ND = Neither agree/Nor disagree; D = disagree; SD = strongly disagree

Section D: Functional factor

The following items refer to the functional factor of the computerised HIS. Please indicate your level of agreement with each item.

The items:	SA	A	NA/ND	DA	SD
The HIS is user-friendly	1	2	3	4	5
The computerised HIS is worth the time and effort required to use it	1	2	3	4	5
My patient care decisions are based on computerised HIS recommendations	1	2	3	4	5
I apply computerised HIS program recommendations to my own work	1	2	3	4	5
I am unable to use the computerised HIS in my work	1	2	3	4	5
I do not use the computerised HIS in my daily work	1	2	3	4	5

Notes: SA = strongly agree; A = agree; NA/ND = Neither agree/Nor disagree; D = disagree; SD = strongly disagree

Section E: Technical factor

The following items refer to the technical factor of the computerised HIS. Please indicate your level of agreement with each item.

The items:	SA	A	NA/ND	DA	SD
The computerised HIS provides the precise information you need	1	2	3	4	5
The computerised HIS provides reports that seem to be approximately what you need	1	2	3	4	5
The computerised HIS provides sufficient information	1	2	3	4	5
The computerised HIS provides clear output information	1	2	3	4	5
The computerised HIS program is integrated into the work	1	2	3	4	5
The information I access from the computerised HIS makes my work easier	1	2	3	4	5
I use the computerised HIS to guide my practice	1	2	3	4	5
The computerised HIS information is always updated	1	2	3	4	5

Notes: SA = strongly agree; A = agree; NA/ND = Neither agree/Nor disagree; D = disagree; SD = strongly disagree

Section F: Cultural factor

The following items refer to the cultural factor of the computerised HIS. Please indicate your level of agreement with each one:

The items:	SA	A	NA/ND	DA	SD
You are satisfied with the computerised HIS installed in your department	1	2	3	4	5
The computerised HIS makes our department's work easier	1	2	3	4	5
The computerised HIS improves the quality of our department's work	1	2	3	4	5
The computerised HIS installed in your department is successful	1	2	3	4	5

Notes: SA = strongly agree; A = agree; NA/ND = Neither agree/Nor disagree; D = disagree; SD = strongly disagree

Section K: Legal factors

The following items refer to the legal factor of the computerised HIS. Please indicate your level of agreement with each item.

The items:	SA	A	NA/ND	DA	SD
There are general polices for hospitals to have expert personnel in ICT departments	1	2	3	4	5
There are legal penalties for healthcare professionals who do not use the computerised HIS correctly	1	2	3	4	5
There are specific polices for healthcare professionals' use of computerised HIS	1	2	3	4	5

Notes: SA = strongly agree; A = agree; NA/ND = Neither agree/Nor disagree; D = disagree; SD = strongly disagree

Section G: Benefits and barriers to the use of HIS

Indicate the effect that you think the HIS program has on:

The items:	SA	A	NA/ND	DA.	SD
Computerised HIS facilitate patient care	1	2	3	4	5
Computerised HIS provide continuity of patient care	1	2	3	4	5
Computerised HIS facilitate decision-making on patient care	1	2	3	4	5
Computerised HIS facilitate communication with healthcare teams	1	2	3	4	5
Computerised HIS give high-quality information	1	2	3	4	5
Computerised HIS achieve individualised care	1	2	3	4	5
Computerised HIS help the coordination of patient care	1	2	3	4	5
Computerised HIS achieve individualised care	1	2	3	4	5
Computerised HIS improve research development	1	2	3	4	5
I use the computerised HIS to review patients' problems and give written, general medical information to patients	1	2	3	4	5
I use the computerised HIS to follow the results of a particular test or investigation over time, and to collect patient information for various medical declarations	1	2	3	4	5
I use the computerised HIS to enter daily notes, order clinical biochemical laboratory analyses and obtain information on investigation or treatment procedures	1	2	3	4	5
I use the computerised HIS to answer questions on general medical knowledge (e.g., concerning treatment, symptoms and complications)	1	2	3	4	5

Section A: Demographic information

1. Please select your gender:

1. Male
2. Female

2. Please select your role:

1. Manager, department manager
2. Physician
3. Nurse or midwife
4. Other health staff (please identify)

3. Age:

☐ 25 to 29 years ☐ 30 to 39 years

☐ 40 to 49 years ☐ 50 years +

4. Education level

☐ Diploma ☐ Bachelor's ☐ Master's ☐ PhD

5. Department

☐ Emergency ☐ Medical
☐ Medical records ☐ Surgery
☐ Accounting ☐ Laboratory
☐ Radiology ☐ Pharmacy

6. Work experience in this hospital

☐ 3 to 5 years ☐ 6 to 10 years
☐ 11 to 15 years ☐ 16 to 20 years
☐ 21 years or more

استبانه

العوامل التي تعزز أو تعوق من تطوير

وتنفيذ نظام المعلومات الصحية المحوسب

في الأردن كدولة نامية

PhD study

تعليمات

- تهدف هذه الاستبانه إلى استكشاف آراء العاملين في مجال الرعاية الصحية من ناحية العوامل التي تعزز أو تعيق من تطوير وتنفيذ نظام المعلومات الصحية المحوسب في الأردن باعتبارها إحدى الدول النامية.

- من أجل صحة ودقة هذه الدراسة فإن من المهم معرفة رأي وخبرة الأفراد تجاه نظام المعلومات الصحية المحوسب، لذا يرجى الإجابة على جميع فقرات الاستبانه.

- إن هدف الاستبانه هو إتمام دراسة بعنوان **العوامل التي تعزز أو تعوق من تطوير وتنفيذ نظام المعلومات الصحية المحوسب في الأردن كدولة نامية** للحصول على درجة الدكتوراه، لذا لن يكون هناك أي إشارة تدل على من قام بتعبئة الاستبانه وستعامل جميع الاستبانات بسرية تامة.

الجزء الأول: المعلومات الديموغرافية

1. الجنس	أ. ذكر	ب. أنثى		
2. الوظيفة	أ. مدير أو مدير قسم	ب. طبيب/ة	ج. ممرض/ة أو قابلة	د. أخرى أذكرها .....
3. العمر	أ. 25 – 30 سنة	ب. 30 – 40 سنة	ج. 40 – 50 سنة	د. أكثر من 50 سنة
4. المستوي التعليمي	أ. دبلوم	ب. بكالوريوس	ج. ماجستير	د. دكتوراه
	أ. الطوارئ	ب. الأقسام الطبية	ج. السجلات الطبية	د. الجراحة
5. القسم	ع. المحاسبة	م. المختبر	ن. الأشعة	و. الصيدلية
ن. مدة الخدمة في المكان الحالي	أ. 3 – 6 سنوات	ب. 6 – 11 سنة	ج. 11 – 16 سنة	د. 16 – 21 سنة

الجزء الثاني: عوامل المنظمة

الرجاء اختيار الإجابة المناسبة من العبارات التالية والتي تشير إلى **عوامل المنظمة** في استخدام ودعم نظم المعلومات الصحية المحوسبة.

العبارات	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
الاقتراحات التي أقدمها بخصوص نظام المعلومات الصحية المحوسبتؤخذ بعين الاعتبار.	1	2	3	4	5
التغييرات المقدمة لنظام المعلومات الصحية المحوسبذات أهمية لإنجاز عملي اليومي.	1	2	3	4	5
يمكنني نظام المعلومات الصحية المحوسبمن الدقة في العمل.	1	2	3	4	5
نظام المعلومات الصحية المحوسبيحسن من جودة العمل.	1	2	3	4	5
الأشخاص الذين يعملون في قسم نظام المعلومات الصحية المحوسبمتعاونين.	1	2	3	4	5
أجد جميع المعلومات التي احتاجها عند استخدام نظم المعلومات الصحية المحوسبة.	1	2	3	4	5
تكون المعلومات شاملة في نظم المعلومات الصحية المحوسبة.	1	2	3	4	5
المعلومات المسجلة في نظام المعلومات الصحية المحوسبمهمة لرعاية المرضى.	1	2	3	4	5
نظام المعلومات الصحية المحوسبيجعل عملي أكثر سهولة.	1	2	3	4	5
نظام المعلومات الصحية المحوسبيجعل عملي أكثر توترا.	1	2	3	4	5

الجزء الثالث: العوامل الإدارية

الرجاء اختيار الإجابة المناسبة من العبارات التالية والتي تشير إلى **العوامل الإدارية** في استخدام ودعم نظم المعلومات الصحية المحوسبة.

العبارات	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
نظام المعلومات الصحية المحوسب سهل الاستخدام.	1	2	3	4	5
أستطيع الوصول إلى ما أحتاجه من المعلومات باستخدام نظم المعلومات الصحية المحوسبة.	1	2	3	4	5
باستخدام نظم المعلومات الصحية المحوسبة، أستطيع الوصول إلى المعلومات التي أحتاجها أينما كنت.	1	2	3	4	5
باستخدام نظم المعلومات الصحية المحوسب،أستطيع الوصول إلى المعلومات التي أحتاجها في الوقت الذي أريده.	1	2	3	4	5
عدد أجهزة الحاسب كافية.	1	2	3	4	5
أقوم بمساعدة الكادر الطبي باستخدام نظام المعلومات الصحية المحوسبفي عملهم.	1	2	3	4	5
الوقت مقبول الذي استغرقه في عملية توثيق البيانات في نظم المعلزمات الصحية المحوسب.	1	2	3	4	5
أنا متأكد من مصداقية البيانات الموثقة في نظم المعلومات الصحية المحوسبة.	1	2	3	4	5
تلقيت التدريب الكافي في كيفية استخدام نظم المعلومات الصحية المحوسبة.	1	2	3	4	5

الجزء الرابع: العوامل الوظيفية

الرجاء اختيار الإجابة المناسبة من العبارات التالية والتي تشير إلى **العوامل الوظيفية** في استخدام ودعم نظم المعلومات الصحية المحوسبة.

العبارات	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
استخدام نظام المعلومات الصحية المحوسب يعتبر وديا.	1	2	3	4	5
أن استخدام نظام المعلومات الصحية المحوسب يستحق الوقت والجهد المناسب.	1	2	3	4	5
قراري تجاه المريض يعتمد على توصيات نظم المعلومات الصحية المحوسبة.	1	2	3	4	5
أنا أوصى باستخدام نظام المعلومات الصحية المحوسب في عملي.	1	2	3	4	5
أنا غير قادر على استخدام نظام المعلومات الصحية المحوسب في عملي.	1	2	3	4	5
أنا لا استخدام نظام المعلومات الصحية المحوسب بشكل يومي في عملي.	1	2	3	4	5

الجزء الخامس: العوامل التقنية

الرجاء اختيار الإجابة المناسبة من العبارات التالية والتي تشير إلى **العوامل التقنية** في استخدام ودعم نظم المعلومات الصحية المحوسبة.

العبارات	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
يقدم نظام المعلومات الصحية المحوسب المعلومات الدقيقة لمن يحتاجها.	1	2	3	4	5
يقدم نظام المعلومات الصحية المحوسب التقارير المناسبة لمن يحتاجها.	1	2	3	4	5
يقدم نظام المعلومات الصحية المحوسب المعلومات الكافية.	1	2	3	4	5
يقدم نظام المعلومات الصحية المحوسب المعلومات الواضحة.	1	2	3	4	5
تم دمج نظام المعلومات الصحية المحوسب في العمل.	1	2	3	4	5
المعلومات التي أحصل عليها باستخدام نظام المعلومات الصحية المحوسب تجعل عملي أكثر سهولة.	1	2	3	4	5
استخدم نظام المعلومات الصحية المحوسب كدليل إرشادي في عملي	1	2	3	4	5
المعلومات في نظام المعلومات الصحية المحوسب يتم تحديثها باستمرار.	1	2	3	4	5

الجزء السادس : العوامل الثقافية

الرجاء اختيار الإجابة المناسبة من العبارات التالية والتي تشير إلى **العوامل الثقافية** في استخدام ودعم نظم المعلومات الصحية المحوسبة.

العبارات	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
أنا راض عن نظام المعلومات الصحية المحوسب الموجودة في قسمي.	1	2	3	4	5
نظام المعلومات الصحية المحوسب يجعل الأداء في القسم سهلا.	1	2	3	4	5
نظام المعلومات الصحية المحوسب يحسن من جودة العمل في القسم.	1	2	3	4	5
نظام المعلومات الصحية المحوسب المعمول به في القسم ناجح.	1	2	3	4	5

الجزء السابع: العوامل القانونية

الرجاء اختيار الإجابة المناسبة من العبارات التالية والتي تشير إلى **العوامل القانونية** في استخدام ودعم نظم المعلومات الصحية المحوسبة.

العبارات	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
توجد سياسات عامة في المستشفيات تنص على وجوب تواجد أقسام لخبراء تكنولوجيا المعلومات والاتصالات.	1	2	3	4	5
توجد عقوبات قانونية للعاملين في مجال الرعاية الصحية الذين يستخدمون نظم المعلومات الصحية المحوسب بشكل خاطئ.	1	2	3	4	5
توجد سياسات خاصة للعاملين في مجال الرعاية الصحية في كيفية استخدام نظم المعلومات الصحية المحوسب.	1	2	3	4	5

الجزء الثامن: فوائد ومعيقات استخدام نظام المعلومات الصحية المحوسب

الرجاء اختيار الإجابة المناسبة من العبارات التالية والتي تعتقد بأن لها الأثر في استخدام ودعم نظم المعلومات الصحية المحوسبة.

العبارات	أوافق بشدة	أوافق	محايد	لا أوافق	لا أوافق بشدة
يسهل نظام المعلومات الصحية المحوسب رعاية المرضى.	1	2	3	4	5
يوفر نظام المعلومات الصحية المحوسب الاستمرارية في رعاية المرضى.	1	2	3	4	5
يسهل نظام المعلومات الصحية المحوسب اتخاذ القرار المناسب لرعاية المرضى.	1	2	3	4	5
يسهل نظام المعلومات الصحية المحوسب التواصل مع فريق تقديم الرعاية الصحية.	1	2	3	4	5
استخدام نظام المعلومات الصحية المحوسب يقدم المعلومات بجودة عالية.	1	2	3	4	5
يحقق نظام المعلومات الصحية المحوسب خصوصية المريض.	1	2	3	4	5
يضمن نظام المعلومات الصحية المحوسب التعاون والتنسيق في الرعاية الصحية.	1	2	3	4	5
يحسن ويطور نظام المعلومات الصحية المحوسب من ناحية الأبحاث العلمية.	1	2	3	4	5
استخدم نظام المعلومات الصحية المحوسب لمعرفة معلومات وتشخيص المرضى و إضافة إلى ذلك أزود المرضى بالمعلومات اللازمة خطيا.	1	2	3	4	5
استخدم نظام المعلومات الصحية المحوسب في متابعة أو التحقق من نتائج التحاليل للمرضى وجمع معلومات المرضى من الوثائق الطبية المحوسبة الأخرى.	1	2	3	4	5
استخدم نظام المعلومات الصحية المحوسب لإدخال الملاحظات اليومية و التحاليل المخبرية و السريرية والحصول على المعلومات التي احتاجها عن المريض وإجراءات العلاج.	1	2	3	4	5
يقدم نظام المعلومات الصحية المحوسب الإجابات التي احتاجها بخصوص المعلومات الطبية مثل العلاج والأعراض والمضاعفات...الخ.	1	2	3	4	5

Appendix B: Guide to the Interview Questions

The following guide to the interview questions contains the questions asked during all interviews. The list is thematically arranged, and does not reflect the sequence used during each interview. Additional questions were often added according to the situation.

This guide is presented in two languages: English, and the Arabic versions of the original English questions. Translations into Arabic were required as Arabic is the language used in Jordan.

B.1 English version

Based on the main objectives of the study, the interview addressed the following questions:

1. How is patient healthcare data collected?
2. What tools are used to collect and store (record) the collected data?
3. How are healthcare data kept and managed over time?
4. Where are the collected data sent?
5. Which of the collected data are used?
6. Who uses the data, and what do they use it for?
7. How is patient information shared?
8. What are the problems related to data collection, report preparation and information flows from the health facilities to higher levels?
9. What are the factors promoting the development and implementation of HIS in hospitals?
10. What are the factors hindering the development and implementation of HIS in hospitals?

Appendix C: Ethical Clearance (Letters of Agreement)

C.1. Letter of introduction to the MOH in Jordan, from the University of New England.

Associate Professor Penny Paliadelis
Head, School of Health
Faculty of The Professions
Armidale NSW 2351
Phone 61 2 6773 3653
Fax 61 2 6773 3666
Email: hoshealth@une.edu.au
www.une.edu.au/health

1 April 2013

Dear Sir / Madam

Re: Mohammad Hashem Alharafsheh request for data information

Mr Mohammad Hashem Alharafsheh is enrolled in a Doctorate of Philosophy (PhD) in the School of Health at the University of New England, Armidale, Australia.

Mohammad is doing his thesis on 'The factors that promote or hinder the development and implementation computerized health information system in Jordan, a developing country'.

For his study Mohammad requires this background information to be able to complete his thesis project. We would appreciate your support in supplying information from the four sectors that should be completed in around 5 months.

Yours sincerely

[redacted]

A/Professor Penny Paliadelis
Acting Head of School

Appendix D: Information Sheet for Participants

Factors promoting or hindering the development and implementation of computerised health information systems (HIS) in Jordan, a developing country

- This questionnaire explores the views of healthcare professionals on the factors promoting or hindering the development and implementation of computerised HIS in Jordan, a developing country.
- For the validity of this study, it is very important for us to learn about your personal opinions and experiences with HIS. Therefore, we encourage you to answer all questions that follow.
- We would be grateful if you would complete this questionnaire and return it to a designated person or the anonymous collection box.
- All information is confidential. The dissemination and publication of the results will *not* include any references identifying participants.

Mohammad Alharafsheh
BSC Nursing, MSC Public Health
PhD Candidate
halharaf@une.edu.au

The supervisor: Dr Barry Tolchard
Deputy Head of School: Research & HDR
btolchar@une.edu.au

University of New England.
School of Health (Health Care Administration) Medicine College
Armidale, NSW 235,1 Australia
Phone(Work) +61 2 6773 3643
Fax (Work) +61 2 6773 3666

Appendix E: Consent Form

CONSENT FORM

for PARTICIPANTS

Research Project: The factors that promote or hinder the development and implementation of computerised health information systems (HIS) in Jordan, a developing country.

I, ……,
have read the information contained in the Information Sheet for Participants and any questions I have asked have been answered to my satisfaction. Yes/No

I agree to participate in this activity, realising that I may withdraw at any time. Yes/No

I agree that research data gathered for the study may be published using a pseudonym. Yes/No

I agree that I may be quoted using a pseudonym. Yes/No

I agree to the interview being audio recorded and transcribed. Yes/No

I would like to receive a copy of the interview transcription. Yes/No

I am at least 18 years of age. Yes/No

…….. …….

Participant Date

The researcher:
Mohammad Alharafsheh (PhD Student)
April 2013
University of New England
School of Health

Appendix F: Focus Group and Interview Schedule

During the collection of qualitative data, the researcher will spend eight weeks conducting interviews (based on eight hours' work per week). The interviews will be conducted in four hospitals, with two weeks spent in each hospital.

Each hospital will have four interviews:

1 June to 14 June in hospital 1.

14 June to 28 June in hospital 2.

29 June to 13 July in hospital 3.

14 July to 28 July in hospital 4.

All interviews will be record.

Researcher: Mohammad Alharafsheh

University of New England

School of Health