QATAR UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

CLINICAL INFORMATION SYSTEM: MEASURING END-USER SATISFACTION IN A GOVERNMENTAL HOSPITAL IN QATAR

BY

MOATASEM AHMAD MAHMOOD AL-HASSON

A Project Submitted to

the College of Business and Economics

in Partial Fulfillment of the Requirements for the Degree of

Master of Business Administration

January   2020

COMMITTEE PAGE

The members of the Committee approve the Project of
Moatasem Al-Hasson defended on 04/12/2019.

<div style="text-align: right;">

_____
Emad Ahmed Mohammed Abushanab
Thesis/Dissertation Supervisor

_____
Mohd Nishat Faisal
Committee Member

</div>

Approved:

_____

Dr. Adam Mohamed Fadlalla, Dean, College of Business and Economics

ABSTRACT

AL-HASSON, MOATASEM, AHMAD MAHMOOD, Masters: January : 2020,

Master of Business Administration

Title: Clinical Information System: Measuring End-User Satisfaction in a Governmental Hospital in Qatar

Supervisor of Project: Emad Ahmed Mohammed Abushanab.

Clinical services in hospitals are too diversified and include different kinds of care patient needs. To be efficient, clinical services need to be supported by a promising clinical information system. As we did not find enough literature talking about the clinical information system (CIS) in terms of end-users' satisfaction in the context of Qatar, we took the initiative and conducted this research to study this vital feature of CIS. In this paper, the satisfaction of three categories of clinicians was tested. These job categories included: physicians, nurses, and pharmacists who work in Al Wakra Hospital, a member of Hamad Medical Corporation (HMC) which is the dominant healthcare provider in Qatar. The study tested the following research questions:

RQ 1: What are the key variables affecting the satisfaction of CIS end-users in Al Wakra Hospital?

RQ 2: What are the levels of CIS end-user satisfaction in Al Wakra Hospital?

The research model incorporated five independent variables measuring their impact on end-user satisfaction. These variables included: information quality, system quality, service quality, professional maturity, and personal innovativeness. The survey questionnaire was divided into two sections: the first one collected demographic data while the second one included measured related to different variables included in the study. Necessary approval was collected from Qatar University IRB Committee. The

questionnaire was distributed to targeted end-users. A total of 308 responses was collected, out of which there were eight incomplete responses. After removing three outliers, the necessary analysis was conducted for the remaining 297 useful responses. The following analyses were conducted including frequencies, descriptive analytics, reliability, validity, Pearson's correlation, and regression.

Results revealed reliable measures and variables as Cronbach's alpha exceed minimally accepted scoring. Collinearity was eliminated via conducting necessary Pearson's Correlation and VIF test. One variable, system quality, was found to be insignificant and was eliminated from the model. Four hypotheses were supported, while one hypothesis was not supported eventually. Research findings can be used by related decision-makers to improve understanding of reasons impacting end-users' satisfaction. Listening to the end-users and considering their feedback can help optimize CIS and reach the best possible utilization of it. Nonetheless, there are certain limitations to the study that need to be kept in mind.

Keywords: Clinical information system, CIS, Electronic health record, EHR, Satisfaction, Information quality, IQ, System Quality, SyQ, Service Quality, SeQ, Professional Maturity, PM, Personal Innovativeness, PI

DEDICATION

I dedicate this work to Allah, then to my family, Qatar University and Hamad Medical Corporation. The university has provided me, and other students, with an educational environment that helped me complete this project. The administration at Hamad Medical Corporation has provided me with all possible support and means for implementing what I have learned at Qatar University. I feel proud of working in such corporations that appreciated highly educated personnel.

ACKNOWLEDGEMENT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

Background

Clinical services in hospitals are diversified and include different kinds of care which patients require. There are two kinds of care which are normally provided in health care facilities: direct and indirect care. The direct care is the one most people look for, realize as the core service in hospitals and, hence, appreciate its excellence. For example, surgical procedures and medical treatment are well known among different clients visiting a hospital for different kinds of treatment. On the other hand, indirect care incorporates services such as administrative and clerical work to facilitate and organize patient flow. Supportive services could be categorized as direct or indirect patient care depending on the level of clinical contact with patients. For example, laboratory work has direct contact with patients but still is not intended for itself, but it is required before making medical decisions.

Every member mentioned above has valuable input in the overall patient care. There is no single person or discipline in any given hospital who can provide holistic care to every patient. They need a collaborative work of a highly educated and well-trained team of co-workers. Each member is responsible for part of the work with clear roles and responsibilities to complete the work and participate in having the right service provision considering time constraints. This is essential for making the right decision regarding the care choices and pathways to select.

Such a tremendous amount of work and cooperation is in need of a mean to facilitate communication among its members and to ensure no piece of information is missed or not appropriately endorsed. Hence, clinical documentation has been developed to achieve this

task. Documentation consists of written or visual explanations reflecting what the software does, how it uses it, and how it processes it (Aggelidis & Chatzoglou, 2012). Historically, paper-based documentation has been used widely to maintain a record of the care provided. In the old times, the amount of data that clinicians used to deal with was simple and not complicated. It did not require that much of team members to participate in the process of decision making. Even when the process has grown, it was still controllable with paperwork.

Nonetheless, there were times when delays that happened in transferring the data or even transferring the wrong pieces of data. The number of patients accessing hospital services increased tremendously. Noticeable advancements have occurred in the patient care provided by different disciplines including advancement in technology. The team has expanded and diversified with more and more sub-specialties. Clinical procedures required before making decisions regarding patient care have increased as well with an increased number of patients requiring 24/7 care.

Although such direct and indirect services have led to better results in the patient care, it also had negative consequences. With this increasing amount of work and required communication among the team, some mistakes occurred in the patient care due to the absence of ideal communication as well as difficult access to information. This was accompanied by clinicians experiencing different levels of stress and dissatisfaction due to the overwhelming amount of work. It became very challenging to retrieve a single piece of information that required the support of a team of medical records personnel working 24/7 to ensure uninterrupted service.

This is not an easy work. In fact, it is a time-consuming task to read the patient medical record, considering so many sheets to be looked at and review to find a piece of information. Moreover, legibility was a problem that led to considerable, time-consuming mistakes with different impacts (Wilbanks, et al., 2018). Hence, trials started to reach a more realistic and practical solution. Eventually, paper-based documentation became no more suitable and cannot meet the clinicians' requirements to provide timely and satisfactory services. In fact, the need for a sophisticated system had come to the attention of decision-makers as well as opportunity catchers.

Due to these problems and requirements combined with the improvements in technology, including hardware, software, and network connectivity; the clinical information system (CIS) was developed with promising plans to facilitate communication among different healthcare providers. CIS refers to the applications designed to reflect patient care by documenting all relevant data electronically using computers (Karimi, Poo, & Tan, 2015). A good definition can be as follows: a considerably big database management system that processes patient data in aim to help make a proper clinical decision by healthcare providers such as review accessing patients' records to plan and evaluate care (Dictionary M. , n.d.).

Generally speaking, clinicians do not need any more to do documentation on paper. They no more need to wait for hours to find the information they need to review before taking a right clinical decision. Nowadays, all clinical findings, tests, assessments, consultations, and medical checkups are saved online and can be reached from anywhere in a timely manner. CIS has obviously improved the communication required to complete the work. It is of some clicks and all necessary information appears ready to review.

The system was a real shift in the way of doing the work. Moreover, it has solved the problem of legibility and made clinical data easier to find (Baumann, Baker, & Elshaug, 2018). In fact, CIS implementation has led to improved overall patient care and safety. Hence, it did support the overall efficient care provided to different patient categories. Moreover, confidentiality was maintained, and data became even more secure. Clinical information systems have been developed and have been becoming smarter than before to assist clinicians in doing their work. Drop lists, data entry using voice orders, visual layouts, and user-friendly data organization are just examples of how these systems made clinicians' life easy (Aldosari, Al-Mansour, Aldosari, & Alanazi, 2018).

Information Technology has led to tremendous improvements in the way of communicating data among different healthcare providers. Despite of the massive investments in clinical information systems worldwide, there were considerable consequences that hinder reaching the ideal utilization of the system. One of the most concerning consequences is the clinicians' satisfaction, which severely impacted the success of the system implementation. In fact, end users are the main stakeholders who can practically decide how efficiently the system can be utilized (Sebetci, 2018).

The matter of end-users' satisfaction is real as well in the case of Qatar, where significant investments to implement and improve the utilization of clinical information system have been made in the public health care sector. The decision-makers aimed to improve the overall patient care provided. On the other side, it is well perceived among healthcare providers how the implemented system has improved communication of clinical information. As above mentioned, implementing new systems is typically accompanied by some obstacles that hinder it from reaching its best results.

Al Wakra Hospital (AWH)

Al Wakra Hospital (AWH) is a general hospital that is a member of Hamad Medical Corporation (HMC). HMC is the dominant governmental health care facility in the State of Qatar. AWH was established in 2012 in Al Wakra city occupying more than 130 thousand square meters of site and more than 304 thousand square meters of land. It aims to provide comprehensive services with high quality to different age groups. It primarily targets the population of the southern areas which face growing population and community needs (Al Wakra Hospital, n.d.).

Al Wakra Hospital has a 325-bed capacity, including 248 beds for general and acute care and 77 beds for critical care, burns, and high dependency patients. More so, there are 77-day beds. Al Wakra Hospital has a total of 10 operating rooms designed for major surgeries and 2 operating rooms for minor surgical interventions (Al Wakra Hospital, n.d.).

It does provide diversified services, including emergency care, general medical and surgical care as well for adults and pediatrics, serving both genders. It has different patient care units responsible for specialized services. These units include, but not limited to, critical care units for medical and surgical care, operating room, labor room, burns unit, dialysis unit, emergency department, pediatric and neonatal care units, inpatient units, outpatient clinics, and daycare services. AWH has the necessary supportive departments to maintain workflow efficiency. It has a highly equipped laboratory complying with the highest international standards. This lab commitment enables quick and efficient analysis of samples (Al Wakra Hospital, n.d.).

The mission of AWH incorporates improving community wellbeing via providing the highest quality care served by highly competent multidisciplinary team members

considering highest levels of safety, time-efficiency, and effectiveness as well as committing to highest standards of quality care. The hospital vision is to become the hospital of choice for the targeted population by committing to the safest, most efficient, and most compassionate care (Al Wakra Hospital, n.d.).

Al Wakra was accredited by the Joint Commission International (JCI) for meeting its high standards of care and safety. It was also accredited by the College of American Pathologists (CAP) for committing to high standards in lab services. More so, it was recognized by the Surgical Review Corporation (SRC) as a center of excellence for hernia, bariatric, and urology stone services. It is currently under process for application for more accreditations and recognitions (Al Wakra Hospital, n.d.).

Clinical Information System (CIS)

Around five years ago, a clinical information system (CIS) was purchased by HMC and was utilized by all hospitals under the umbrella of HMC. The CIS implemented in HMC was supplied by an American corporation called Cerner. Cerner Corporation was established in 1979 provides health information technology solutions for more than 27,000 facilities around the world as of now. Cerner recently recruits more than 29,000 employees globally (Cerner, n.d.).

In 1997, Cerner introduced the new version of its health information system, called Cerner Millennium, which contributed to increased corporate revenues and profits. This platform supports a comprehensive view of patient care delivered acutely or in the inpatient setting. It acts on integrating sources of care for displaying the best results so that clinicians become well informed (Cerner, n.d.).

Cerner Millennium platform is composed of siloses of highly specialized sub-platforms. These sub-platforms were developed to meet the personal needs of each specialized patient care unit as well as every clinician's expectations. These siloses of data coordinated with each other in the background to communicate clinical data.

Purpose and Contribution of the Research

This paper is intended to study the status of end-user satisfaction, one of the significant challenges against the optimal utilization of the clinical information system implemented in a governmental hospital in Qatar. This research aimed to develop a better understanding of obstacles against reaching optimal end-user satisfaction. This paper intends finding answers to the following questions:

RQ 1: What are the key variables that affect the satisfaction of CIS end-users in Al Wakra Hospital?

RQ 2: What are the levels of CIS end-user satisfaction in Al Wakra Hospital?

The implementation of CIS in Qatar has started since five years. Many steps have been taken to implement it throughout HMC hospitals. Nevertheless, this did not go without obstacles and resistance. Answers to the above questions can act as advice to the decision-makers responsible for implementing and optimizing the clinical information system used in HMC. Hence, the study can help improve the utilization of the costly system by considering the opinion of the keystone stakeholders, i.e., end-users.

Scope of the Study

This study targets healthcare providers, namely physicians, nurses, and pharmacists; who provide direct and indirect patient care. The study focuses on those professionals working in Al Wakra Hospital which is one of the hospitals following Hamad Medical

Corporation (HMC) in Qatar. It has more than 250 beds capacity and considered as a general, governmental hospital that provides care to a wide range of patients with different specialties.

Motivation for the Study

I have been working as a nurse since 2005. I have practiced both paper-based and electronic documentation. I participated in the process of planning for and implementing the clinical information system in my hospital since the early days until full implementation. I have seen how different clinicians did their best to make the system succeed. As a nurse manager, I want to figure out end-user satisfaction and what steps management can take to improve their satisfaction, which will impact their productivity.

Structure of the Study

The study follows the typical structure of research papers. It starts with the abstract, followed by the introduction explaining the purpose of the study and motivation beyond it as well as benefits that could be yielded. Literature review reflects studies conducted in different countries talking about our topic highlighting results about the constructs. In methodology, the model has was developed with corresponding variables and testing measures. Analysis of data collected will be followed with a discussion of results. Paper will be ended with the conclusion, recommendations, and limitations of the study.

CHAPTER 2: LITERATURE REVIEW

In this research, related articles were reviewed concerning the clinical information system and end-user satisfaction. Articles from the Gulf Cooperation Countries (GCC) region were reviewed to see how close hospitals achieved in terms of the satisfaction of end-users. This is important as these hospitals have relatively similar characteristics and employees with similar characteristics. Articles from international hospitals have also been reviewed to benefit from their experiences in CIS implementation and solving related obstacles. The discussion will be provided in the next sections to provide more details including reviewing a well-respected model and developing a new model being more reflective with recent changes. After that, some other factors other researchers considered them significant predictors of end-user satisfaction were reviewed as well.

End-User Satisfaction

It is well perceived among professionals that customer satisfaction is key to the success and sustainability of any product or service. This is obviously true in the case of hospitals where the customer is the end-user, i.e. clinician. These professionals are highly dependent on the clinical information system to complete their work. The satisfaction of end-users of the clinical information system in hospitals is exceptionally essential to successful and efficient provision of care to the patients, hospital customers.

Patients visit healthcare facilities to receive necessary treatment or consultation. They look to have this completed without expecting negative health consequences or having an unjustifiable delay in the service. Patients will look for feedback from others, e.g. friends or relatives, about their experience in different healthcare facilities. Social media can be an efficient tool that customers may use to put their feedback. Nowadays, patients have the

option to select which facility to visit to receive their care. In other words, having multiple options means competition among hospitals to attract customers. Attracting the right number of patients is essential to maintain convincing revenues whether to make profits, in case of the private sector, or maintaining governmental support, in case of the public sector. The consequence of this mixture is attracting and maintain the human talent required to complete the job.

In the aim to have a clear basis, the definition of end-user satisfaction was reviewed. Karimi, Poo, and Tan (2015) have defined satisfaction as the affective status of emotions representing reaction with the clinical information system that clinicians use (Karimi, Poo, & Tan, 2015). It may also be defined as the feeling of pleasure consuming a good or service that met customer expectations (Akter, 2017). In other words, it is the difference between customer expectations and needs and the met ones. It is the difference between customer expectations and real experience (POLAT, 2015) (Nazamul, Mohammad, & Chowdhury, 2019). It is how much clinicians feel happy to use the system, show willingness and motivation to use it every now and then and present appreciation to the system they use (Karimi, Poo, & Tan, 2015). More so, It can be defined as the level of absence of discomfort or negative attitudes toward the use of the system (Jensen, Kushniruk, & Nøhr, 2015).

In a review of different articles measuring clinical information system end-user satisfaction, different results were found. Wilbanks, et al., find that paper-based documentation had consistently lower rates of satisfaction compared to CIS (Wilbanks, et al., 2018). In the area of GCC, different results were figured. In tow studies conducted in Saudi Arabia, physicians reported low to moderated overall satisfaction with CIS (Alsohime, et al., 2019) (Alharthi, Youssef, & Radwan, 2014). In the UAE, a study was

conducted and revealed a high overall satisfaction score (Bani-issa, Al Yateem, Al Makhzoomy, & Ibrahim, 2016). Internationally, a study conducted in Canada reported moderate satisfaction among physicians (Hudson, Kushniruk, Borycki, & Zuege, 2018). Hadji and Degoulet (2016) found low levels of satisfaction among physicians in a longitudinal study conducted in France over 12 years (Hadji & Degoulet, 2016).

In another study conducted in Denmark, physicians and nurses reported a positive experience with CIS (Bossen, Jensen, & Udsen, 2013). This was confirmed by another longitudinal study conducted in the United States that showed improved satisfaction with CIS overtime with increased familiarity with the system (Grout, Cheng, Carroll, Bauer, & Downs, 2018). Another study also conducted in the United States has shown a negative drawback of CIS. It found that CIS worsened physicians' satisfaction (as cited by (Balestra, 2017)). In two studies conducted in North America, it was found that CIS negatively impacted end-user satisfaction and led to increased frustration (Harris, Haskell, & Cooper, 2018) (Marckini, Samuel, Parker, & Cook, 2019).

Variables Influencing End-User Satisfaction of CIS

As a technology system, there are certain factors that affect end-users' satisfaction. This study will start by reviewing the updated Delone and Mclean information system success model (Delone & Mclean, 2003). It was chosen as it was validated by many researches and proved reliable. It was updated by its original developers. Moreover, it is a simple model with a limited number of variables. It consists of three variables that affect satisfaction: quality of information, quality of system and quality of service.

The other variables in the model, i.e. intention to use and use, are not applicable in our case as employees in HMC are mandated to use the system regardless of their satisfaction

status. Hence, they were excluded from our discussion. Due to the scope of our study, the net benefits variable was not included in this study, although it might be referred to it. In the next pages, researches about the three variables were reviewed to figure out their significance and relevance to our research as well as to find out if another related factor can be proposed as well.
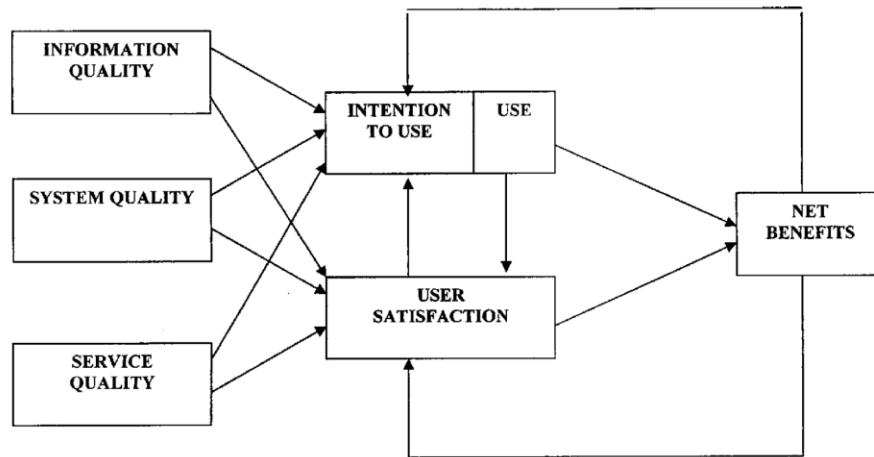
Figure 1: Updated D&M IS Success Model

Information Quality

This variable includes the content issue. In aim to have the content efficient and helps improve the system and clinicians' productivity, it must be complete, relevant, personalized, easy to understand and secure (Delone & Mclean, 2003). Bossen, Jensen and Udsen relate this factor to the relevance, comprehensiveness, accuracy and provision of adequate (2013) overview of clinical work (Bossen, Jensen, & Udsen, 2013). Aggelidis and Chatzoglou have composed this factor from four items: content, accuracy, format and timeliness (Aggelidis & Chatzoglou, 2012).

Comprehensiveness was not added to this factor, despite being important, due to the assumption of clinicians' professionalism is expected (Bossen, Jensen, & Udsen, 2013). It has been found that information quality is significant, in terms of statistics, and positively impacts the overall satisfaction of Electronic Health Records (HER) end-users (Aggelidis & Chatzoglou, 2012). In a study, questions regarding quality and adequacy of information were used to find out the level of quality of information (Despont-Grosa, Fabry, Mullera, Geissbuhlera, & Lovisa, 2004). Next, applicable measures were reviewed.

Comprehensiveness refers to the completeness, sufficiency, and clarity of terms, concepts and overall documentation in the clinical information system meeting the needs of end-users. The importance of this measure arises from the core of the documentation. In aim to have the documentation reaching the right personnel in the right way, it needs to be comprehensive. It must reflect all necessary information in each part. It needs to be enough to satisfy the requirements of the clinicians to make the right decision.

One of the obstacles, for example, is the use of abbreviations that are not approved to be used in the said hospital. This can lead to serious mistakes that may affect patient safety. Hence, the terms used in documentation need to be easily understood and commonly used among clinicians working in the same hospital. If a patient record failed to meet these specifications, then consequences will follow. With this in mind, researchers had found contradictory results. In a paper, researchers found that terms and concepts reflected in the CIS were clear (Hudson, Kushniruk, Borycki, & Zuege, 2018). In another study, results were the opposite and participants reflected the system provides inadequate information (Khalifa & Alswailem, 2015). Hence, it is wise to use this measure to test the quality of information reflected in CIS.

Accuracy refers to how much information is reflective of the clinical findings being correct and precise. Shall the information reflected in CIS be inaccurate; then, the main difference between paper-based and electronic documentation will not be easily distinguished in terms of efficiency. Clinicians have benefited a lot from using CIS in their daily communication and documentation. Measures to improve patient safety have been improved. The ability to monitor the quality of care provided has become easier than the days of paper-based documentation. In a study, it was found that this variable is one of the strongest predictors of overall satisfaction. This is due to the fact that for a piece of information to be useful and of importance to be considered while making clinical decisions, it should be accurate. This is essential with no doubt (Alharthi, Youssef, & Radwan, 2014). This is obvious in a study that revealed lower satisfaction due to inaccurate information (Khalifa & Alswailem, 2015).

Relevance refers to the information presented. It is about the level of convenience with information available for use and presentation (Sebetci, 2018). Presentation of the information in the right location in CIS is crucial to decide its relevance to every decision. It is how information can be arranged and organized to make relevant information related to a certain decision easier to approach. Once clinicians are able to retrieve information that satisfies their needs, then, their work can be better organized and completed (Dictionary M.-W. , n.d.). Aggelidis and Chatzoglou (2012) have used this measure in their study to test information quality. It was used in different studies as well and the majority of participants reported information in CIS being relevant (Alharthi, Youssef, & Radwan, 2014). It was suggested by Delone and Mclean (2003) as a typical measure of the quality of information.

Timeliness is all about providing up-to-date information. In a study, it was found that half of the staff surveyed found information in CIS is timely (Aldosari, Al-Mansour, Aldosari, & Alanazi, 2018). Aggelidis and Chatzoglou (2012) have considered timeliness a typical measure of the quality of information. They found it to play an essential role in the quality of information. The importance of this measure originates from the fact that health care provides require data to make the right decision on time in aim not to have negative consequences over the health of their patients. As CIS is the mean of communication among different health care providers, they all need to have necessary data updated and reflects current status (Sebetci, 2018) (Alharthi, Youssef, & Radwan, 2014).

Nevertheless, it happens that necessary data are not available on time to clinicians. There could be multiple reasons. These may include amount of workload, availability of enough human resources, availability of enough computers for data entry, conducting efficient training, availability of adequate IT support as well as conducting quality improvement projects that can detect reasons for delays in data entry and ways to remove obstacles.

Medical records security is a serious concern. This concern arises from the fact that every piece of information reflected in the medical record is vital, costly in terms of time and money, and essential for decision-making as well as needs to be confidential to avoid consequences. A patient entered in a hospital would have certain expectations regarding his/her health and possible options. None of the patients is expected to give for-granted permission to access his/her information by every person. They will give permission only to those involved in his/her care. They do not expect a procedure or treatment that is already

conducted needs to be repeated simply because results or related information were lost due to not having control over access to medical records or being not safely secured.

The clinicians put tremendous efforts in preparation for the ultimate patient care decision. They do not expect their efforts to be accessed by irrelated personnel or being not securely saved. They have certain expectations with this regard that need to be measured to sort its reasons and possible solutions. Aggelidis and Chatzoglou (2012) have considered security a typical measure of the quality of information. It was suggested by Delone and Mclean (2003) as a typical measure of the quality of information. It was used in different studies as well, and more than half of participants in one study agreed that information in CIS is secure (Alharthi, Youssef, & Radwan, 2014) (Sebetci, 2018).

Hence, the following hypothesis was proposed:

H1: Information quality has a positive impact on the end-user satisfaction.

System Quality

System quality verifies the system functionality level being suitable to support the work being tested (Bossen, Jensen, & Udsen, 2013). The presence of effective clinical information systems has led to many improvements in health care. This result, in particular, is more than enough to find ways to improve utilization of the CIS. In the aim to have a system reach such a result, it must be fully utilized. Moreover, in aim to be fully utilized, it must meet end-users' expectations. One of the most important characteristics required to meet those expectations is the system quality. End users expect CIS to be able to meet their personal needs. A clinic providing diabetic care has different requirements from those needed for an operating room.

With nowadays requirements to finish work on time, clinicians look for a system that meets this need without failure. They need a system that is reliable to complete their work and available for use. Applicable measures to variable test personalization, system speed or response time, ease of use, interface, reliability, availability, and adaptability (Delone & Mclean, 2003) (Aggelidis & Chatzoglou, 2012). It has been found that system quality is significant, in terms of statistics, and positively impacts the overall satisfaction of EHR end-users (Aggelidis & Chatzoglou, 2012). Moreover, Aldosari, Al-Mansour, Aldosari and Alanazi (2018) have found the system quality variable to be one of the crucial factors for predicting end-user satisfaction. Compared to a paper-based system, CIS was found of higher quality (Ayaad, et al., 2019). Next, applicable measures were reviewed.

Personalization is the state of making or designing something to satisfy the individual requirements of end-user, such as making it as belonging to that person (Dictionary L. , n.d.). In the case of CIS, personalization refers to the state of designing CIS to meet the special requirements of each patient care unit by making alterations in system access so that it becomes easier for users to reach the information they need more frequently than others. This need is undeniable in the case of highly specialized departments where they have very unique requirements to have work done. The system shall be designed to consider quick access for the frequently required information with the possibility to access those less required in a way that will not interfere with the workflow (Schweitzer, Lasierra, & Hörbst, 2016).

System speed is defined as the time consumed between the start of activity and results being displayed on the screen or being printed out (Aggelidis & Chatzoglou, 2012). This feature has been selected to measure end-user satisfaction since CIS is a computer-based

system. Hence, the ability to process work quickly is essential in differentiating CIS from paper-based documentation (Aggelidis & Chatzoglou, 2012). In fact, the need for speed is coming from the need to complete work quickly, which in turn arises from the need to accommodate the increased workload and patient census with the continuously limited number of healthcare providers and budget constraints.

In two studies, system speed has been found to be one of the principal identifiers of end-user satisfaction of CIS (Hudson, Kushniruk, Borycki, & Zuege, 2018) (Alsohime, et al., 2019) (Alharthi, Youssef, & Radwan, 2014). Having sluggish access or log in or low speed reduces the end-user ability to perform their work and provide the optimal clinical work. This, in turn, adds more stress on their shoulders leading to reduced satisfaction. In a study, slow CIS, among other variables, led to decreased end-user satisfaction (Khalifa & Alswailem, 2015) (Hudson, Kushniruk, Borycki, & Zuege, 2018). Basically, system response time is one of the most frequent issues identified as negatively impacting end-user satisfaction (Hudson, Kushniruk, Borycki, & Zuege, 2018).

The interface is defined as the area of interaction between the system and the end-user where necessary job actions can be ordered, imported, processed and exported (Aggelidis & Chatzoglou, 2012). It concerns data presentation, coherence, and localization (Despont-Grosa, Fabry, Mullera, Geissbuhlera, & Lovisa, 2004). It is how the home page, as well as subsequent windows, are designed in a way that end-users will not feel lost and will be able to reach necessary information quickly. The number of clicks is essential to ensure this feature is satisfied. Color coding is essential and needs to be selected carefully to avoid confusing health care providers. Healthcare providers are already under stress of the need to complete their work and provide the best patient care without errors.

End-users do expect the system interface to be organized in an attractive way that can help reduce stress or at least not adding more stress. Organizing the icons is important to make the interface user-friendly. This feature is considered as one of the essential determinants of end-user satisfaction of CIS (Hudson, Kushniruk, Borycki, & Zuege, 2018). In a study, it was found that system interface is one of the most frequent issues identified as negatively impacting end-user satisfaction (Hudson, Kushniruk, Borycki, & Zuege, 2018). The importance of the proper interface design was highlighted in a study conducted in Argentina where a system was used, and end-user satisfaction improved accordingly (Luna, Rizzato Lede, Otero, Risk, & Bernaldo de Quirós, 2017).

Ease of use refers to how much CIS is user-friendly. It is how much the system use is free of effort (Khalifa & Alswailem, 2015). It is about the amount of manipulations required to complete work (Despont-Grosa, Fabry, Mullera, Geissbuhlera, & Lovisa, 2004). This feature is considered essential to be available for many reasons. One of those reasons is increasing the efficiency of the system via reducing time learn the system, reducing the amount of IT support, and the increasing number of patient records that could be accessed within a certain period. Hence, the utilization of the system will be improved, and the productivity of healthcare providers will be enhanced.

This feature is seen different among health care providers and reflects the quality of the system. Hence, this feature can improve end-user satisfaction and level of enjoyment making it easier to reach the required information shortly (Aggelidis & Chatzoglou, 2012). Hence, it can be used to test end-user satisfaction with the quality of CIS. Some researchers found this feature strongly correlated to end-user satisfaction (Aldosari, Al-Mansour, Aldosari, & Alanazi, 2018). Physicians reported the lowest rate of satisfaction in the sense

of ease of use among other healthcare providers in a study conducted in France in a longitudinal study (Ologeanu-taddei, Morquin, & Vitari, 2016).

Availability refers to the state of being able to be used or obtained (Dictionary L. , n.d.). In case of CIS, availability refers to the state of having CIS being able to be used by healthcare providers. In aim to have a system well utilized and causing a satisfactory level of satisfaction among its end-users, it needs to be available for them to use it every time they need it. System availability is a significant feature of system performance (Wu, 1987).

System availability necessitates having the supportive infrasture accompanied by the right software and hardware as well. It needs to be increased workload tolerant. It is required to serve without being affected by technical faults. This needs tolerance to work offline while the system being repaired. It must not be affected by power shutdown, software upgrade, database recognition, and operations faults. It must as well be able to recover after faults promptly without interfering workflow (Gray & Siewiorek, 1991). In aim to satisfy end-users expectations, the system should be supported with efficient preventive maintenance. This feature was considered typical to measure information quality by Delone and Mclean (2003). This was one of the poorly rated measures in a study conducted in Saudi Arabia due to the limited provision of computers required to complete the job (Alsohime, et al., 2019).

Reliability refers to the state of being trustworthy or dependable to complete the job (Dictionaries, n.d.). It is a probability that a certain amount of data being successfully transferred from one source to another (Lin & Yeh, 2015). Whether the system is dependable to transfer or process a satisfactory amount of workload electronically including uploading, downloading, updating and retrieving data or not, is essential to

enhance end-users' satisfaction. For a system to be reliable, all of its components need to be designed carefully to ensure work can always be done. This measure was considered typical to measure information quality (Delone & Mclean, 2003).

Adaptability is how much a system can be adjusted to meet unique or new requirements (Dictionary L. , n.d.). In an aim to be adaptable, CIS shall not be rigid and needs to be flexible to complete different task levels including complex and simple ones. This measure was considered typical to measure information quality (Delone & Mclean, 2003).

Hence, the following hypothesis was proposed:

H2: System quality has a positive impact on the end-user satisfaction.

Service Quality

This variable is crucial as it reflects how much employees are supported to complete their work. This support can be either internal by corporate staff or external via vendor or developer. The role of support is with no doubt essential element of the success of any project. This is very true in the case of CIS implementation. The importance of this factor has been increasing over time due to the continuous development of information technology. Lack of enough or proper support could lead to unjustified increased workload and stress as well as the increased time of service. Ultimately, this leads to the decreased overall productivity of staff and hospital via creating such constraints in the workflow (Delone & Mclean, 2003). Hence, having the right support can lead to a smooth flow of work, minimized troubles, reduced stress and enhanced end-user satisfaction.

The support reviewed here is not only directly relevant to the information technology department. It also relates to the management support. The last one is essential to the extent that the first one will not work without it. Management control budget and, more

importantly, decision-making authority is needed to proceed with junctional movements (Sebetci, 2018). The status of software and hardware is very important to the effective flow of work. It was reported that the absence of updated software and hardware could be the constraint in the provision of the right, timely service. On the other side, downtime has been an irritating incident that clinicians may not like. This depends on the way of handling it. Whether staff are trained well to handle it or not is not the only concern. Rather, it is related to frequency and consequences.

IT support is defined as the kind of support provided to the end-user considering their needs to use the CIS, including both resources: internal and external. Absence of proper support would lead to unresolved pitfalls and under-utilized CIS which will ultimately lead to end-user disappointment and low satisfaction. Hence, there are two kinds of IT support; internal and external. The first one is the one provided by in-house staff and the most common and most accessible to solve daily problems. The external one is usually of limited period till the IT personnel knowledge and skill develop and mature to gradually wean from the external support, which is usually very expensive and is mostly utilized during warranty periods or for advanced, non-urgent issues (Aggelidis & Chatzoglou, 2012).

With this in mind, both kinds of IT support were reviewed. Aldosari, Al-Mansour, Aldosari, and Alanazi have found IT support as one of the strong predictors of end-user satisfaction (Aldosari, Al-Mansour, Aldosari, & Alanazi, 2018) (Hossain, Quaresma, & Rahman, 2019). This could be explained by the recommendation that was raised in a separate study revealing the importance of quickly solving any technical difficulty as reported from the perspective of end-users of the clinical information system. This includes conducted necessary modifications and maintenance that would facilitate their work

(Mohamadali & Ab Aziz, 2017). In a study, system support was rated low in terms of satisfaction (Alharthi, Youssef, & Radwan, 2014). Sebetci found that the relationship between support and overall satisfaction has the most significant correlation among the obsered variables (Sebetci, 2018). This confirms a logical fact that merely adopting and implementing CIS will not ensure its success without considering ongoing IT support to overcome expected obstacles (Alsohime, et al., 2019).

Top management support is thought to be an essential factor in enhancing the system usability via providing proper resources and acting to optimize the system in response to the feedback of end-user. Such support is expected to lead to improved end-user satisfaction. Bani-Issa, Al Yateem, Al Makhzoomy, and Ibrahim have found a lack of support from the administration as a key reason for low overall support (Bani-issa, Al Yateem, Al Makhzoomy, & Ibrahim, 2016). In another study, computer availability was one of the most determinants of end-user satisfaction (Khalifa & Alswailem, 2015). Aldosari, Al-Mansour, Aldosari, and Alanazi have identified top management support as an important influence of end-user satisfaction (Aldosari, Al-Mansour, Aldosari, & Alanazi, 2018).

In a study conducted in Bangladesh, it was found that the availability of the right technical infrastructural is an influential determinant of end-user intention to use the clinical information system (Hossain, Quaresma, & Rahman, 2019). As the system matures, the need for effective downtime procedures increases over time. Downtime procedures refer to the policy and protocol that end-users need to follow during the time CIS does not function fully or partially. In one study, end-users were found to be unsatisfied

with downtime procedure including its ambiguity and incomprehensiveness as well as the level of preparedness to interact with (Khalifa & Alswailem, 2015).

Hence, the following hypothesis was proposed:

H3: Service quality has a positive impact on the end-user satisfaction.

Professional Maturity

Qatar has many functioning hospitals. The majority of those are governmental. There are also private hospitals functioning in different locations in Qatar with different bed capacities. The number of patients has been increasing, and the workload is continuously added. The amount of stress is not that low. Considering the diversity among healthcare providers, it is wise to study the effect of their preparedness to utilize the system and its impact on their satisfaction efficiently. The number of physicians, nurses, and pharmacists working in Al Wakra Hospital alone is tremendous and needs to be studied well.

The amount of governmental expenses to improve services in the hospital are huge as well. The importance of this variable comes from the need to ensure fairness of survey results. As above specified, employees working in Al Wakra Hospital came from different countries. The question here is: how much their professional maturity impacts their satisfaction after using the CIS in their hospital? Their response regarding this question was required to sort out possible reasons beyond their satisfaction scores. The aim was to sort out the exact reasons for the results of our study. Not all countries have the same IT infrastructure. Not all employees have the same capabilities including computer literacy. Hence, it was believed that having professionally mature end-users will undoubtedly enhance their satisfaction (Ifinedo, 2016).

This variable will be tested using three measures: education, training, and experience. Ifinedo (2016) found a positive relationship between education and the level of satisfaction of CIS end-users. In the study, it was found that nurses with higher education attainment have shown higher readiness to use CIS. Training is defined as the user's conception regarding the coaching provided before and throughout the system's usage (Aggelidis & Chatzoglou, 2012) (Handayani, Hidayanto, & Budi, 2018). It is the kind of teaching in terms of knowledge and practice that end-users receive to learn how to utilize a CIS including its essential hardware and software effectively. Keeping this in mind, for a CIS to succeed, it is vital to provide the right training that meets end-users' expectations being on a continuous basis and recognizing personal differences and needs. This will lead ultimately to improve their satisfaction accordingly (Aldosari, Al-Mansour, Aldosari, & Alanazi, 2018), (Aggelidis & Chatzoglou, 2012).

Training was found to negatively impact the end-user satisfaction (Aggelidis & Chatzoglou, 2012). Alsohime, et al., found a significant impact of training over end-user satisfaction (Alsohime, et al., 2019). In a study, end-users considered the training they received inadequate (Alharthi, Youssef, & Radwan, 2014) (Bani-issa, Al Yateem, Al Makhzoomy, & Ibrahim, 2016). In two distinct longitudinal studies conducted in the United States and France, end-users showed improved satisfaction with CIS over time due to increased familiarity with the system (Grout, Cheng, Carroll, Bauer, & Downs, 2018) (Hadji, Martin, Dupuis, Campoy, & Degoulet, 2016).

Hence, the following hypothesis was proposed:

H4: Professional maturity has a positive impact on the end-user satisfaction.

Personal Innovativeness

This factor was proposed by Agarwal and Prasad (1998) as an independent variable for computer use acceptance. They defined it as the intention to experiment new information technology (Agarwal & Prasad, 1998) (Yi, Fiedler, & Park, 2006). Personal innovativeness was identified as one of the significant factors to predict prosperous acceptance and use of CIS as well as end-user satisfaction (Hossain, Quaresma, & Rahman, 2019) (Turana, Tunç, & Zehirc,, 2015). The effect of personal innovativeness over the adoption of computer systems was supported by low experience (Hwang, 2014). Rosen (2005) found personal innovativeness to have a significant role in predicting behavioral intentions to use technology (Rosen, 2005). In a study conducted in Brazil, it was found that resident physicians had higher satisfaction with the CIS than senior ones (Duarte & Azevedo, 2017). This could probably be due to the personal willingness to use technology. Jackson, Yi, and Park (2013) identified the prosperous role of personal innovativeness over the ease of use of technology. Practically, this can be beneficial for the success of new information technology by selecting enthusiastic to facilitate system implementation (Jackson, Yi, & Park, 2013).

Hence, the following hypothesis was proposed:

H5: Personal innovativeness has a positive impact on the end-user satisfaction.

Summary of Literature Review

In this study, we reviewed articles related to the topic of the clinical information system (CIS) and its impact on end-users' satisfaction. Reviewed articles studied the status of CIS implemented in different countries and found different levels of satisfaction. We found five crucial variables that impacted this satisfaction. These independent variables included:

information quality, system quality, service quality, professional maturity and personal

innovativeness. Measures relevant to each variables were retrieved from literature as well.

Five hypotheses were proposed and were further examined in this study (see Table 1).

Table 1.List of Proposed Hypotheses

H#	Hypothesis
H1	Information quality has a positive impact on the end-user satisfaction
H2	System quality has a positive impact on the end-user satisfaction
H3	Service quality has a positive impact on the end-user satisfaction
H4	Professional maturity has a positive impact on the end-user satisfaction
H5	Personal innovativeness has a positive impact on theend-user satisfaction

CHAPTER 3: RESEARCH METHODOLOGY

The study aims to measure factors affecting CIS end-users' satisfaction. A thorough literature review was conducted to find out the significance of these factors, which were found to be significant. A survey was conducted to measure the satisfaction among healthcare providers working in Al Wakra Hospital. Those variables and related measures have been adopted from previous literature.

Research Model

The model used for the purpose of this research (see Figure 2) was adopted and modified from the model developed by Delone and McLean (Delone & McLean , 2003). Our modified model is composed of five predictors (see Figure 2). The first predictor, information quality, captures the CIS content issue. This variable was tested using five measures: comprehensiveness, accuracy, relevance, timeliness, and security (Delone & McLean , 2003) (Bossen, Jensen, & Udsen, 2013) (Aggelidis & Chatzoglou, 2012) (Sebetci, 2018). The second predictor, system quality, measures the desired functionality characteristics of CIS to support the work. Qualities that will be measured include personalization, response time, interface, ease of use, availability, reliability, and adaptability (Bossen, Jensen, & Udsen, 2013) (Delone & Mclean, 2003) (Sebetci, 2018).

The third predictor, service quality, is based on the understanding that having the right support can lead to a smooth flow of work and either avoid or quickly solve system pitfalls. Qualities that will be measured include IT support (whether in-sourced or out-sourced), top-management support, provision of up-to-date hardware and software and efficiency of downtime procedures (Delone & Mclean, 2003). The fourth predictor, professional maturity, will be measured using three qualities related to education,

experience, and training. They have been identified as significant predictors of end-user acceptance and satisfaction of CIS (Aldosari, Al-Mansour, Aldosari, & Alanazi, 2018). The fifth predictor, personal innovativeness, will be tested using measures about readiness, enthusiasm, and willingness to use or try new technology. Related hypotheses have been already stated in the body of the literature review after each related section to make it easier to capture the model and understand the background behind each hypothesis.
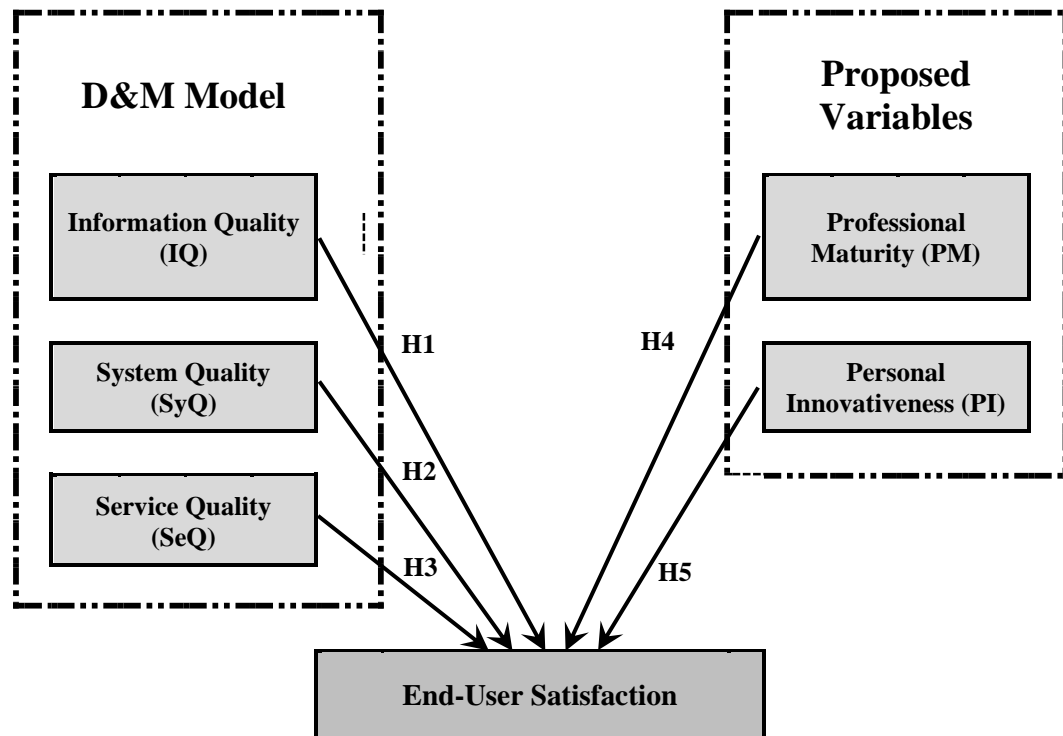

Figure 2: Proposed Model

Research Approach and Design

This research aimed to find critical factors impacting the satisfaction of end-users of the clinical information system in one of the governmental hospitals operating in the state of Qatar. As explained in the previous section, the survey intended to collect

perceptions of end-users regarding both the independent variables (information quality, system quality, service quality, professional maturity, and personal innovativeness) as well as the dependent variable (end-user satisfaction).

This research used the quantitative method. It utilized primary and secondary data resources. The questionnaire for the purpose of this study was designed with two main sections. The first part addressed the sample demographics including gender, age, education level, profession, experience in the profession, experience in using CIS and computer skills level and level of computer skills. The second part focused on the study variables and their measures. The factors that formulated the independent variables were chosen correctly based on an extensive literature review and through primary research conducted by inquiring with over ten users. There was a total of thirty-nine items in the second section covering all variables. A 5-point Likert scale was used for measures in this section to rate participants' level of agreement/disagreement as it was displayed in Table 2. Kindly refer to APPENDIX B for a copy of the questionnaire used in this study.

Table 2: Five-point Likert scale

Value	Interpretation
1	Strongly disagree
2	Disagree
3	Neither agree nor disagree
4	Agree
5	Strongly agree

Sample and Data Collection

The survey was built using the English language only as it is the only common language among all participants. Surveying software (Google Forms) was utilized to

distribute the questionnaire electronically, and a link was sent to all potential participants in Al Wakra Hospital. The link was sent through email and social media in an attempt to collect the maximum number of participants. The survey was open for participation for a period of 15 days, starting from October 18th, 2019 till November 1st, 2019. A reminder was sent to employees to increase the number of participants. Hard-copy questionnaires were also distributed on a direct collection basis upon survey completion. They were distributed over 15 days, from October 18th, 2019, till November 1st, 2019 as well.

There were advantages for each kind of survey distribution, i.e. online and hardcopy. The online is more comfortable for the surveyor to collect responses and analyze results as well as real-time viewing of data and responses. Nevertheless, the online survey carried extra costs. On the other side, hard copies have been necessitated to be used due to the low response rate from one of the three categories proposed to be studied in this research which is pharmacists. Extra efforts were required to ensure the survey reached all participants categories to ensure responses are representative of the population being studied (physicians, nurses, and pharmacists), and results are generalizable.

In both cases, i.e. softcopy and hardcopy, the survey was designed in a way to allow respondents to complete the questionnaire in an average of five to six minutes. The aim was to encourage participants to provide their inputs and to reduce the nonresponse rate due to time factor. Moreover, a consent form was displayed prior to proceeding with the online survey. For hardcopy surveys, a consent form was given to participants (see APPENDIX A). The consent form provided brief information about study and approvals ensured confidentially and anonymous participation and required participants' approval to

participate voluntarily. Hence, the risk of bias was reduced. Participants were given the option to receive study results.

Validity of the Questionnaire

The questionnaire was reviewed and verified by the QU-IRB committee to ensure the validity and integrity of the instrument used as well as compliance with essential ethical practices. Committee has approved the questionnaire as it met all ethical requirements and conditions with approval number QU-IRB 1144-E/19. Kindly refer to **Error! Reference source not found.** for approval copy.

Statistical Methods

In this study, specific statistical procedures were used to ensure that work results are believable. Information regarding participants' demographics including gender, age, education, profession, experience in the profession, experience with CIS and level of computer skills, were collected. These demographics were analyzed using SPSS to find out their frequency and percentages. Model variables were analyzed for central tendency (mean) and measures of dispersion (minimum, maximum and standard deviation). Reliability analysis using Cronbach's alpha was conducted to ensure internal consistency. Correlation coefficient and variation inflation factor (VIF) was used to sort out the risk of multicollinearity. Regression analysis determined the level of significance of the model and all independent variables. A one-way ANOVA test was conducted to verify if a significant difference exists between male and female participants. Since the scales were developed from literature, the content was valid. Based on the results of these analyses, factors determining end-user satisfaction were found out.

CHAPTER 4: DATA ANALYSIS AND DISCUSSION

In this research, the survey questionnaire was distributed to the employees working in Al Wakra Hospital. It targeted three professions: physicians, nurses, and pharmacists. These professions have the highest percentage of CIS usage in any given hospital. The questionnaire was distributed using both online and in hard copies. The first page displayed the consent form with all necessary information asking at of the page for the participant's approval before proceeding. There were 308 responses, out of which there were 8 non-useful responses and 3 outliers. In order to test the hypotheses proposed in this study, further analysis was conducted using IBM-SPSS software for the useful 297 responses.

In this chapter, details of the analysis results will be provided, including reliability, validity, linear regression, Pearson's correlation, frequencies, and descriptive analytics. In aim to clean data, missing responses were kept as they were minor and not going to affect results. Responses with major defects were excluded from the analysis. Outlier criteria were set to 3 standard deviations to ensure a higher percentage of correctness. Hence, three outliers were determined and excluded. Ultimately, there was a total of 297 useful responses, for which further analysis was conducted.

Frequencies and Percentages

Descriptive statistics were used to find out the frequency of responses for the demographic variables, as shown in Table 3. Three was a total of 297 responses that were further analyzed after excluding incomplete responses and eliminating outliers. The study included respondents irrespective of their gender, age, education level, profession, experience in the profession, experience in using CIS and computer skills level. Females composed 68.5% of the sample compared to 31.5% for male respondents. Age groups were

represented as follows: 21.5% were between 20-30 years, 61.3% were between 31-40 years, 11.4% were between 41-50 years and 4.4% were above 51 years. In terms of education, 8.8% hold diploma degree, 78.5% hold bachelor's degrees, 7.7% hold a master's degree while 4.4% hold PhD. In terms of a profession category, 8.4% of the sample were physicians, 89.2% were nurses and 0.3% were pharmacists.

In terms of years of experience in the profession, 3% of the sample had 1-2 years, 9.1% had 3-5 years, 46.5% had 6-10 years, while 40.7% had more than 11 years of experience in the profession. In terms of experience in using CIS, 23.9% of the sample had 1-2 years, 59.3% had 3-5 years, 13.8% had 6-10 years, while 1.7% had more than 11 years of using CIS. In terms of computer skills, 8.8% of the sample had necessary skills, 21.2% had sufficient skills, 40.1% had moderate skills, 26.9% had advanced skills while 2% had very advanced skills.

Table 3: Demographics' Frequencies and Percentages

	Frequency	Percentage
Gender		
• Male	93	31.5
• Female	202	68.5
• Not Reported	2	
Age (in years)		
• 20-30	64	21.5
• 31-40	182	61.3
• 41-50	34	11.4
• 51+	13	4.4
• Not Reported	4	
Education		
• Diploma	26	8.8
• Bachelor	233	78.5
• Master	23	7.7
• PhD	13	4.4
• Not Reported	2	

	Frequency	Percentage
Profession		
• Physician	25	8.4
• Nurse	265	89.2
• Pharmacist	1	.3
• Not Reported	6	
Experience in profession (in years)		
• 1-2	9	3.0
• 3-5	27	9.1
• 6-10	138	46.5
• 11+	121	40.7
• Not Reported	2	
Experience in using CIS (in years)		
• 1-2	71	23.9
• 3-5	176	59.3
• 6-10	41	13.8
• 11+	5	1.7
• Not Reported	4	
Computer skills		
• Basic	26	8.8
• Sufficient	63	21.2
• Moderate	119	40.1
• Advanced	80	26.9
• Very advanced	6	2.0
• Not Reported	3	

In an aim to rule out if there was a difference between both genders regarding variables, one-way ANOVA was conducted. The following hypotheses were tested:

$$H_0: \; Mean \; of \; Variable <> for \; Male \; and \; Female \; Samples$$

$$H_0: \; Mean \; of \; Variable = for \; Male \; and \; Female \; Samples$$

As displayed in Table 4, there was no significant difference for each of the variables for male and female groups as all significance values exceeded the permissible level of 0.05. Concerning the rest of the demographics, one-way ANOVA was not conducted for them based on the understanding that their results comply with the normal distribution of population components.

Table 4: One-way ANOVA testing gender groups

		Sum of Squares	df	Mean Square	F	Sig.
Information Quality (IQ)	**Between Groups**	.423	1	.423	.884	.348
	Within Groups	139.649	292	.478		
	Total	140.072	293			
System Quality (SyQ)	**Between Groups**	.027	1	.027	.052	.820
	Within Groups	150.117	293	.512		
	Total	150.143	294			
Service Quality (SeQ)	**Between Groups**	.235	1	.235	.460	.498
	Within Groups	149.873	293	.512		
	Total	150.108	294			
Professional Maturity (PM)	**Between Groups**	.573	1	.573	.990	.321
	Within Groups	169.535	293	.579		
	Total	170.108	294			
Personal Innovativeness (PI)	**Between Groups**	.609	1	.609	1.056	.305
	Within Groups	168.884	293	.576		
	Total	169.492	294			
Satisfaction (S)	**Between Groups**	.001	1	.001	.001	.976
	Within Groups	185.419	293	.633		
	Total	185.420	294			

Descriptive Statistics

Descriptive statistics provide fundamental features of measured variables giving a short summary of their corresponding data. In our study, four descriptive statistics were selected to be reported, namely minimum, maximum, mean and standard deviation. Descriptive statistics were calculated for every measure in the study individually. Table 5 displays criteria which was used to indicate the level of agreement with measures. The data in Table 6 indicates that the mean values of items under information quality (IQ) were between 3.92 and 4.02. Hence, this reflects high agreement with every statement under IQ. Standard deviation finds how much concentrated are the values around the mean. In the case of IQ, standard deviation values were found to vary between 0.790 and 0.882. This

refers that the sample had close values to the means of statements under IQ. Hence, there was a concentration of opinions around the means.

Table 5: Mean scale and criteria

Mean	Criteria
1.00 – 2.33	Low agreement with the statement
2.34 – 3.66	Moderate agreement with the statement
3.67 – 5.00	High agreement with the statement

Table 6: Descriptive statistics for independent variable information quality (IQ) items

Information Quality		Min	Max	Mean	Std
IQ1	CIS content meets my needs	1	5	3.92	.865
IQ2	CIS provides complete information	1	5	3.98	.822
IQ3	Information provided in CIS is accurate	1	5	3.96	.805
IQ4	CIS information is credible	1	5	3.96	.790
IQ5	Information from CIS is relevant to the tasks and decisions I take	1	5	4.00	.812
IQ6	CIS contains up-to-date information	1	5	4.02	.780
IQ7	Information stored in the system is protected	1	5	3.97	.882

Close results were found in the values of means and standard deviations of statements under system quality (SyQ). In terms of means, values shown in Table 7 fell into two groups. The first group means ranged from 3.51 to 3.64 reflecting moderate agreement about five statements under SyQ. The second group means ranged from 3.73 to 3.87 reflecting high agreement. With five statements under SyQ. These values reflect moderate agreement Standard deviation values varied from 0.863 to 0.990. These values also reflect that respondents were generally focusing their opinions around the mean. Hence, the results revealed that the sample generally had moderate agreement with statements under SyQ.

Table 7: Descriptive statistics for independent variable system quality (SyQ) items

System Quality		Min	Max	Mean	Std
SyQ1	CIS provides personalized information	1	5	3.87	.885
SyQ2	CIS addresses my personal needs	1	5	3.64	.981
SyQ3	Time required to access information in CIS is appropriate for me	1	5	3.51	.990
SyQ4	CIS interface is usable for completing my work	1	5	3.78	.889
SyQ5	CIS is an easy-to-use system	1	5	3.78	.938
SyQ6	I don't need help when using CIS	1	5	3.57	.988
SyQ7	The system is always available for me to use	1	5	3.51	.967
SyQ8	Accessing the system is convenient for me (24x7)	1	5	3.59	.956
SyQ9	I can depend on the system to complete my work	1	5	3.78	.860
SyQ10	I find the system to be flexible to interact with	1	5	3.73	.863

Close results were found in the values of means and standard deviations of statements under service quality (SeQ). In terms of means, values shown in Table 8 fell into two groups. In the first group, two measures means were 3.26 and 3.61. This reflected moderate agreement regarding two statements under SeQ. In the second group, means of rest of measures ranged from 3.66 and 3.92, reflecting high agreement about ten out of twelve statements under SeQ. Standard deviation values varied from 0.886 to 1.091. These values also reflect that respondents were generally focusing their opinions around the mean. Despite the standard deviation values reflect a wider range, the values of mean have still continued to reflect moderate agreement. Hence, the results revealed that the sample had a high agreement with ten statements and moderate agreement with two statements under SeQ.

Table 8: Descriptive statistics for independent variable service quality (SeQ) items

Service Quality		Min	Max	Mean	Std
SeQ1	Hamad IT department provides sufficient support for CIS users	1	5	3.82	.930
SeQ2	Hamad IT department provides prompt service for CIS users	1	5	3.80	.941

Service Quality		Min	Max	Mean	Std
SeQ3	Hamad IT personnel have the knowledge to do their job	1	5	3.91	.913
SeQ4	Hamad IT personnel are supportive	1	5	3.92	.887
SeQ5	The chain of command with IT department is efficient and suitable	1	5	3.76	.907
SeQ6	Vendor support to advanced CIS pitfalls is suitable	1	5	3.61	.886
SeQ7	Top management provides all resources needed	1	5	3.73	.905
SeQ8	Top management supports all needed training for users	1	5	3.79	.906
SeQ9	Hardware used for CIS is the latest in the field	1	5	3.66	.928
SeQ10	Software and add-ons used in HMC is new and always get updated	1	5	3.73	.905
SeQ11	Downtime occurrences negatively impact flow of work	1	5	3.69	1.038
SeQ12	Downtime, when happens, is not solved efficiently	1	5	3.26	1.091

Close results were found in the values of means and standard deviations of statements under professional maturity (PM). In terms of means, values shown in Table 9 ranged from 3.98 to 4.03. These values reflected high agreement with statements under PM. Standard deviation values varied from 0.792 to 0.823. These values also reflect that respondents were generally focusing their opinions around the mean. The low range of standard deviation values reflects a higher level of concentration of respondents' opinions around the mean. Hence, the results revealed that the sample generally had high agreement with statements under PM.

Table 9: Descriptive statistics for independent variable professional maturity (PM) items

Professional Maturity		Min	Max	Mean	Std
PM1	My level of Education positively supports the effective use of CIS	1	5	3.98	.823
PM2	My professional experience supports the effective use of CIS	1	5	4.03	.792
PM3	My training provided by HMC supports the effective use of CIS	1	5	4.00	.813

Close results were found in the values of means and standard deviations of statements under personal innovativeness (PI). In terms of means, values shown in Table 10 were 3.50 for one item and 3.91 and 3.92 for the other two ones. The first item mean value reflected moderate agreement with that item. The other two values reflected high agreement with those two items. Standard deviation values varied from 0.844 to 0.942. These values reflected that respondents were generally focusing their opinions around the mean. Despite the fact that the standard deviation values reflected a wider range, the values of mean have still continued to reflect either moderate or high agreement. Hence, the results revealed that the sample had generally moderate agreement with statements under PI.

Table 10: Descriptive statistics for independent variable professional innovativeness (PI) items

Personal Innovativeness	Min	Max	Mean	Std
PI1 If I heard about a new information system, I look for ways to use it	1	5	3.91	.856
PI2 Among my peers, I am the first to try out new information technologies	1	5	3.50	.942
PI3 I like to experiment with new information technologies	1	5	3.92	.844

Close results were found in the values of means and standard deviations of statements under satisfaction (S). In terms of means, values shown in Table 11 ranged from 3.91 to 4.08. These values reflect high agreement with statements under S. Standard deviation values varied from 0.819 to 0.872. These values also reflect that respondents were generally focusing their opinions around the mean. Despite the standard deviation values reflect a wider range, the values of mean have still continued to reflect the moderate agreement. Hence, the results revealed that the sample generally had high agreement with statements under the dependent variable.

Table 11: Descriptive statistics for dependent variable satisfaction (S) items

Satisfaction		Min	Max	Mean	Std
S1	I recommend using CIS to others	1	5	4.08	.872
S2	CIS has met my expectations	1	5	3.91	.819
S3	I feel comfortable while using CIS	1	5	3.93	.848
S4	Overall, I am satisfied with CIS	1	5	3.98	.847

Lastly, the means of items under each variable were calculated as displayed in Table 12. Variables means ranged from 3.67 to 4.00. These values reflect high agreement regarding every variable in the study. Standard deviation values ranged between 0.691 and 0.794. Despite the broader range of standard deviation values, individually, these values were not high. Hence, there was generally high agreement regarding all variables in the study.

Table 12: Descriptive statistics for all variables

Variable	Min	Max	Mean	Std
Quality of Information (IQ)	1	5	3.97	.691
System Quality (SyQ)	1	5	3.67	.714
Service Quality (SeQ)	1.58	5	3.72	.716
Professional Maturity (PM)	1	5	4	.760
Personal Innovativeness (PI)	1	5	3.77	.760
Satisfaction (S)	1	5	3.98	.794

Reliability and Validity

While reliability is conducted to ensure measures used in a study are consistent, validity, on the other hand, is conducted to find the accuracy of that measure. Reliability refers to how really results can be reproduced again if the test was reconducted under the same conditions. The validity test finds how really measures test what they are expected to

measure. While a reliable measure is not necessarily a valid one, a valid item is generally a reliable one. Hence, both tests are important to conduct.

In terms of validity, survey questions were adopted from studies where the validity of measures was confirmed. Moreover, the questionnaire was piloted with five experts for judgment of content validity and feedback confirmed content validity. With regard to reliability, Cronbach's alpha was used. Cronbach's alpha values for variables were found to vary between 0.821 and 0.955, reflecting a satisfactory to a very satisfactory degree of the instrument used to be homogenous as they all fell above the acceptable threshold of 0.60 (see Table 13) (Hair, Black, Babin, & Anderson, 2014). Hence, internal consistency was confirmed, and results can be reproduced if the test was re-conducted under the same conditions. Kindly refer to APPENDIX C for details of scale reliability statistics.

Table 13: Reliability Statistics

Variable	N of Items	Cronbach's Alpha
Quality of Information (IQ)	7	.929
System Quality (SyQ)	10	.922
Service Quality (SeQ)	12	.931
Professional Maturity (PM)	3	.933
Personal Innovativeness (PI)	3	.821
Satisfaction (S)	4	.955

Correlation

Correlation is conducted to find out the possibility of multicollinearity. Hair, Black, Babin, & Anderson (2014) identified a correlation value of 0.9 as a threshold beyond which substantial collinearity would be questionable. In our study, Pearson's Correlation test was conducted, and values of correlation ranged between 0.464 and 0.761 (see Table 14). Although this looks as a satisfactory level by not passing the acceptable threshold of 0.9,

we felt it is wise enough to be even more conservative and go with the level of ± 0.7. Hence, there is risk of collinearity, although being trivial, which can be due to the combined effect of two or more independent variables, i.e. multicollinearity. Multicollinearity reduces the predictive power of any single independent variable by the extent to which it interrelates with other independent variables (Hair, Black, Babin, & Anderson, 2014).

Table 14: Correlation Matrix

	IQ	SyQ	SeQ	PM	PI	S
IQ	1					
SyQ	.741**	1				
SeQ	.613**	.761**	1			
PM	.620**	.682**	.732**	1		
PI	.464**	.566**	.598**	.603**	1	
S	.700**	.716**	.754**	.741**	.636**	1
**. Correlation is significant at the 0.01 level (2-tailed).

In an aim to ensure the absence of multicollinearity, the variance inflation factor (VIF) was used. VIF, which treats each independent variable as dependent one to find out the degree to which the set of other independent variables explains it. Large VIF values indicate a high degree of multicollinearity among independent variables. The acceptable threshold of VIF is 10 with preference to have it less than 5 (Hair, Black, Babin, & Anderson, 2014). In this study, VIF values for all independent variables ranged between 1.716 and 2.623 (see Table *15* and Table *16*). Hence, the risk of multicollinearity was eliminated. More so, R^2 value, which will be discussed in the next section, is acceptable with a value of 0.72 (see Table *17*). This ultimately reflected that way of measures selection was acceptable.

Regression Analysis

Regression analysis is used to build a statistical model reflecting the relationship between the values of dependent and independent variables. Regression analysis was used with the stepwise method. Outlier criteria was set to 3 standard deviations to ensure a higher percentage of correctness. Three outliers were excluded accordingly. Further regression analysis was conducted. It was found that all variables statistically significant except for variable system quality (SyQ) with the value of 0.412 (see Table 15). This value is higher than the acceptable significance level of 0.05. Hence, this variable was statistically insignificant and was eliminated from the model. Table 16 displays the model coefficients after the elimination of system quality. Note that all variables in this table were significant and, hence, composed the new model.

Table 15: Coefficients of the proposed model

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-.244	.162		-1.512	.132		
Information Quality (IQ)	.308	.055	.269	5.604	.000	.426	2.345
System Quality (SyQ)	.053	.065	.048	.821	.412	.290	3.449
Service Quality (SeQ)	.296	.061	.266	4.827	.000	.323	3.100
Professional Maturity (PM)	.250	.053	.240	4.713	.000	.377	2.650
Personal Innovativeness (PI)	.186	.043	.179	4.326	.000	.574	1.743

Table 16: Coefficients of the model after elimination of insignificant variable SyQ

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Information Quality (IQ)	.317	.056	.285	5.696	.000	.391	2.558
Service Quality (SeQ)	.330	.048	.288	6.885	.000	.560	1.786
Professional Maturity (PM)	.254	.053	.245	4.822	.000	.381	2.623
Personal Innovativeness (PI)	.191	.043	.183	4.464	.000	.583	1.716

The value of R is used to measure the correlation between dependent and independent variables. It varies from -1 to 1 with a negative signal indicating a negative slope. R^2, on the other side, used to measure line fitness to data and indicates the variation percentage. This value increases with the increased number of predictors in the model. Its value may fit anywhere between 0 and 1 with a value of 1 indicating all points lying on the line, i.e. a perfect fit. Hence, the bigger the R^2 value, the better is the fit. The adjusted R^2 adjusts R for the sample size and number of independent variables. It varies between 0 and 1. A value of 1 indicates a perfect fit, i.e. the model correctly predicts the dependent variable. Lastly, the standard error of the estimate refers to the variability of observed dependent variable values from those of independent variables. Increased clustering of data makes the standard error more significant and vice versa. Hence, it measures accuracy of predictions made by the model (Hair, Black, Babin, & Anderson, 2014).

Before reviewing the values of R, R^2 and standard error of estimate, it would be wise to test the regression assumptions. First, the normal predicted probability (P-P) plot appeared linear (see Figure 3), while the residual plot appeared random with no pattern (see APPENDIX D). Second, the histogram of residuals appeared normally distributed with minor skewness (see Figure 4), and the normal P-P plot appeared with no drastic deviation (see Figure 3). Third, homoscedasticity, which refers to constant variation about the regression line, was confirmed as residual plots showed no considerable difference in distributing data for different X values. For example, there was no very tight distribution of data on one side of the plot and wide distribution on the other side (see Figure 5 and APPENDIX D). Fourth, independence of error, which means that successive observations

are irrelated, was assumed hold as the data was cross-sectional (Hair, Black, Babin, & Anderson, 2014), (Testing Assumptions of Linear Regression in SPSS, n.d.).
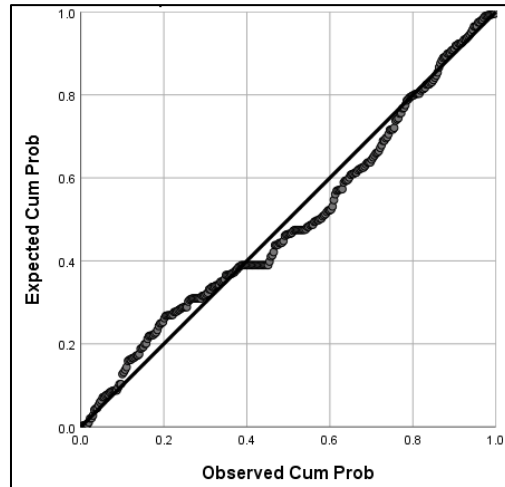
Figure 3: Normal Predicted Probability (P-P) Plot of Regression Standardized Residual
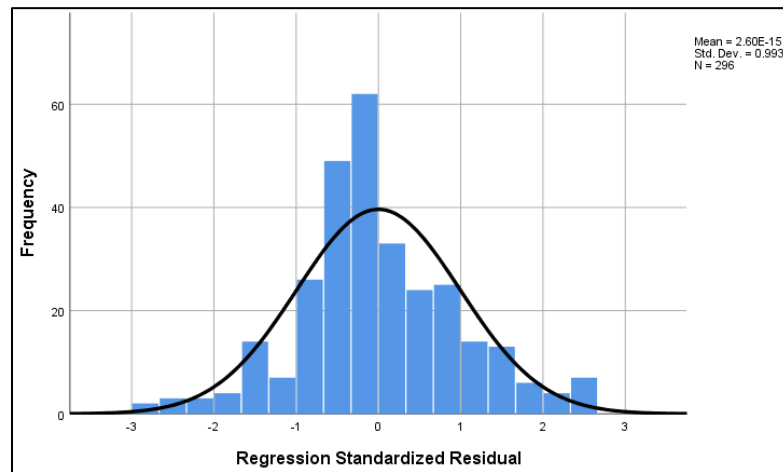
Figure 4: Histogram of standard residuals
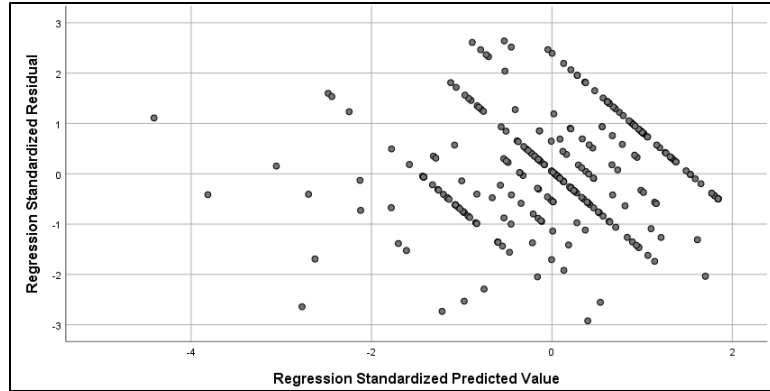
Figure 5: Scatterplot of predicted values and residuals

Now, we can review the values of R, R^2, and standard error of the estimate. In this study, the R-value equaled 0.845, while R^2 equaled 0.714 (see Table 17). This indicates an excellent fit for the points to the line. This value reflects that 71.4% of the dependent variable (end-user satisfaction) can be explained by model predictors, i.e. the four independent variables. The value of the standard error of the estimate, which is the variability of observed values from those predicted ones of the dependent variable, is (0.426). This is less than the value of the standard deviation of different variables. This means that data were clustered close to the regression line. Hence, the level of variability is acceptable.

Table 17: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.845[d]	.714	.711	.426

Analysis of Variance (ANOVA) was conducted to determine the significance of the entire model. The following hypotheses were proposed:

$$H_0: \ \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$$

$$H_0: \ at \ least \ one \ \beta_i \neq 0$$

The null hypothesis stated that no linear relationship exists between the dependent variable with any independent variable. The alternative hypothesis stated that at least one independent variable had a linear relationship with the dependent variable. As the regression significance is less than 0.05 (see Table 18), then the null hypothesis was rejected, and it was concluded that at least one independent variable has a linear relationship with the dependent variable.

Table 18: Multiple Regression Model ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	132.077	4	33.019	182.013	.000e
Residual	52.791	291	.181		
Total	184.868	295			

Hence, the following model was developed with (e) referring to error:

$$End \ User \ Satisfaction = 0.317 \times IQ + 0.33 \times SeQ + 0.254 \times PM + 0.191 \times PI + e$$

CHAPTER 5: CONCLUSION

This study aimed to sort out major challenges against the optimal utilization of the costly clinical information system (CIS). Implementing this system certainly helped improve communication among different health care providers. It made it much easier to retrieve historical and current information necessary to understand patient's clinical condition. Ultimately, the decision will be more confidently and accurately.

For CIS to be fully utilized, there are certain obstacles hindering full utilization of this system that need to be considered and fixed. One of the best resources to have a better understanding of these obstacles can be via health care providers who use this system on a daily basis. In an aim to sort it out, this study was conducted to find out reasons for the dissatisfaction of end-users. Identifying these reasons, and fixing them as well, would ultimately help improve utilization of CIS. This study was conducted in one of the governmental hospitals in the State of Qatar. The survey questionnaires were distributed using both formats of online survey software as well as hardcopy. Data was collected, and further analysis was performed as well.

The first research question aimed at finding key variables affecting the satisfaction of CIS end-users in Al Wakra Hospital. The research model was developed from the literature reviewed. It incorporated five variables: information quality, system quality, service quality, professional maturity, and personal innovativeness. Related measures under each variable were developed from previous literature. The survey questionnaires were distributed to the target sample using weblink and hardcopy.

Necessary analysis was conducted using IBM-SPSS software. The analysis found measures reliable and valid. Results were found reliable as well. Multicollinearity was eliminated by conducting both Pearson's Correlation (values ranged between 0.464 and 0.761) and Variance Inflation Factor (VIF) (values ranged between 1.716 and 2.623). Outlier criteria was set to 3 standard deviations to ensure a higher percentage of correctness.

The five hypotheses were tested with regression analysis. The level of significance of the first independent variable, information quality (IQ), is less than 0.05 and hence is proven significant. So, first hypothesis; *H1*: Information quality has a positive impact on the end-user satisfaction; is supported. The level of significance of the second independent variable, system quality (SyQ), is more than 0.05 (precisely 0.412) and hence is proven insignificant. So, second hypothesis; *H2*: System quality has a positive impact on the end-user satisfaction; is not supported. The level of significance of the third independent variable, service quality (SeQ), is less than 0.05 and hence is proven significant. So, third hypothesis; *H3*: Service quality has a positive impact on the end-user satisfaction; is supported. The level of significance of the fourth independent variable, professional maturity (PM), is less than 0.05 and hence is proven significant. So, fourth hypothesis; *H4*: Professional maturity has a positive impact on the end-user satisfaction; is supported. The level of significance of the fifth independent variable, information quality (IQ), is less than 0.05 and hence is proven significant. So, fifth hypothesis; *H5*: Personal innovativeness has a positive impact on the end-user satisfaction; is supported. Hence, four out of five hypotheses were supported, and one was not supported (see Table 19).

Table 19: Hypotheses testing results

Independent Variable	Dependent Variable	Hypothesis	Beta	t-test	Sig.	Status
Information Quality (IQ)	Satisfaction	H1	.269	5.604	.000	Supported
System Quality (SyQ)	Satisfaction	H2	.048	0.821	.412	Not Supported
Service Quality (SeQ)	Satisfaction	H3	.266	4.827	.000	Supported
Professional Maturity (PM)	Satisfaction	H4	.240	4.713	.000	Supported
Personal Innovativeness (PI)	Satisfaction	H5	.179	4.326	.000	Supported

With this in mind, the answer to the first question was answered, having the following variables statistically supported to have a positive impact on the end-user satisfaction: information quality (IQ), service quality (SeQ), professional maturity (PM) and personal innovativeness (PI). After conducting this thorough analysis, the proposed model was amended to accommodate the findings. The insignificant predictor, i.e. system quality, was eliminated. Accordingly, the final model was developed with four significant independent variables as depicted in Figure 6.
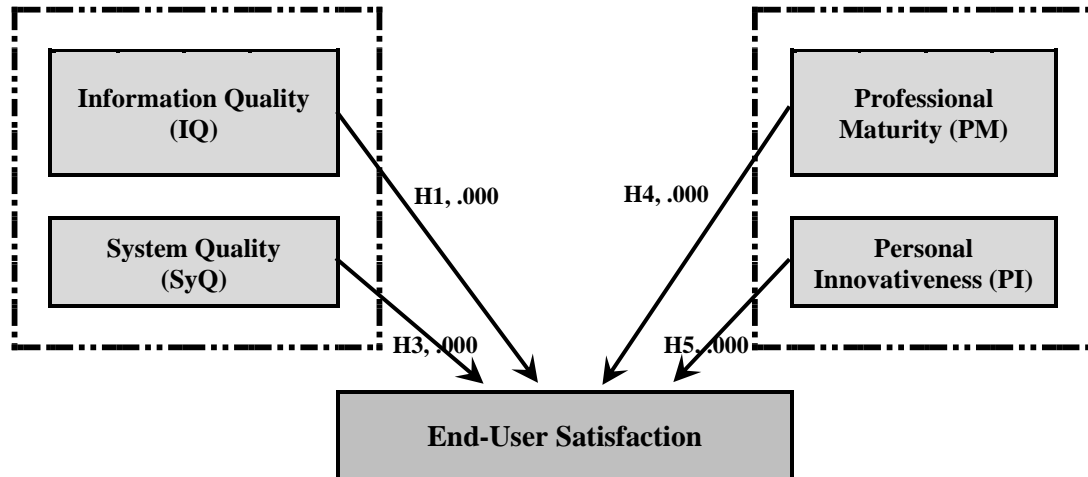

Figure 6: Final Model

With regard to the second question regarding levels of CIS end-user satisfaction in Al Wakra Hospital. Generally speaking, there was high agreement regarding most scales measuring the four significant variables. For the rest of the scales, respondents had moderate agreement regarding them.

Implications and Recommendations

The model has its own meanings. From the model, it was found that all independent variables had a positive relationship with the dependent variables. In other words, if the value of any independent variable increases, the value of the dependent variable increases as well. The independent variable with the greatest impact on end-user satisfaction was the service quality (SeQ) followed by information quality (IQ). Professional maturity (PM) and personal innovativeness (PI) had lesser impact on end-user satisfaction.

The findings of this study revealed that the main reasons for lowering end-user satisfaction included: vendor support, hardware condition, downtime management efficiency as well as willingness to try new information technologies. This reduction in satisfaction is not that much but deserves recognition and proper action implementation toward optimal utilization of the CIS. There was no low agreement about any scale. In fact, most of the scales means and standard deviations reflected high agreement about those scales' statements. Few scales revealed moderate agreement. These results reflect that no single variable dominates level end-user satisfaction. In fact, the four variables having their own participation in improving end-user satisfaction.

By these findings in mind, the answers for the research questions, RQ 1 and RQ 2 were identified. The key variables affecting end-user satisfaction included information quality, service quality, professional maturity, and personal innovativeness. Note that system

quality was eliminated from being a considerable variable as it was statistically insignificant. The levels of satisfaction were generally high, with few scales showed moderate levels.

The findings of this research are important and deserve a thorough review and practical consideration. Health care services can benefit from these findings. By identifying reasons that can enhance end-user satisfaction, decision-makers can enhance the utilization of the CIS implemented in their facilities. They need to have their facility information technology support is optimized to lessen outsourced support from vendors, whether they were locally settled or need overseas telecommunication. The insourced support via an efficient has some considerable advantages. It is less expensive compared to the overseas support. An insourced IT support is also more convenient and satisfactory as well as less time-consuming. Obviously, not every system concern can be solved locally, hence, vendor selection should be made carefully. A support contract needs to be carefully prepared prior to sign it to ensure efficient support considering time constraints.

Another action that needs to be taken is regarding hardware conditions. Management needs to be proactive and have a careful selection of the required hardware. Right equipment selection means avoiding future problems. Simple things can make great difference to end-users. Things like convenient mouse or keyboard are essential to the clinicians who usually give high importance to time management. Repeatedly using inefficient hardware and ignoring end-users' concerns would lead to increased clinicians' stress and lowering their satisfaction. This ultimately would lead to inefficient utilization of CIS.

More so, downtime is a real concern for end-users. Downtime is the time when the CIS is no more editable or accessible, either fully or partially. This can negatively impact workflow including communication among health care providers. This time when the system is down is usually a stressful time for end-users. Usually, there is a limited number of computers that access the CIS for view only. When the downtime is settled, it will be a time of consequences when end-users need to enter clinical data into CIS. Hence, the management needs to think wisely and find a solution to fix the downtime efficiently. This includes minimizing the occurrences of downtime as well as reducing their period. This applies as well to the necessary maintenance time. These times can be scheduled out of peak times.

Lastly, the willingness to try new information technologies is a real concern. It can negatively impact end-users' satisfaction. Understanding this group of clinicians' who do not wish to try new technologies would solve this problem and find a solution for it. This starts from the time of system selection going through a system update. Efficient training can bridge this issue. Continuously communicating with end-users, especially junior staff, can improve understanding of this problem as well as sorting it out.

Limitations and Future Work

Few limitations to this study were identified. One of these limitations is that the findings of this study can be generalized only to health care facilities in Qatar or facilities with the same context, specifically in the GCC. Another limitation is profession representation. More so, there was only one pharmacist who participated in this study. Obviously, the results of this study cannot be generalized to this profession group.

This study can be considered as a foundation for future work. The study finding reflected that the model predictors can explain 74.1% of end-user satisfaction. This implies that there are other independent variables that can enhance the prediction of the level of satisfaction of end-users. More so, further studies can consider the findings of this study as a basis for studies in other countries. Future studies can consider cultural differences to further enhance understanding of reasons impacting end-user satisfaction. This is especially true where employees have mutltinational origins. It would be interesting to find such differences and have better understanding why differences exist. More over, as there is only one pharmacist who participated in this study, another study can be conducted to measure the satisfaction of this important profession group.

REFERENCES

Agarwal, R., & Prasad, J. (1998). A Conceptual and Operational Definition of Personal
Innovativeness in the Domain of Information Technology. *Information systems
research, 9*(2). doi:https://doi.org/10.1287/isre.9.2.204

Aggelidis, V., & Chatzoglou, P. (2012). Hospital information systems. *Journal of
Biomedical Informatics, 45*(3), 566-579.
doi:https://doi.org/10.1016/j.jbi.2012.02.009

Akter, A. (2017). Factors to Improve the Quality of Higher Education in the Non
Government Universities in Bangladesh. *International Journal of Education,
Culture and Society, 2*(132). doi:10.11648/j.ijecs.20170204.15

Al Wakra Hospital. (n.d.). Retrieved November 24, 2019, from Hamad Medical
Corporation: https://www.hamad.qa/EN/Hospitals-and-
services/alwakra/About/Pages/default.aspx

Aldosari, B., Al-Mansour, S., Aldosari, H., & Alanazi, A. (2018). Assessment of factors
influencing nurses acceptance of electronic medical record in a Saudi Arabia
hospital. *Informatics in Medicine Unlocked, 10*, 82-88.
doi:https://doi.org/10.1016/j.imu.2017.12.007

Alharthi, H., Youssef, A., & Radwan, S. (2014). Physician satisfaction with electronic
medical records in a major Saudi Government Hospital. *Journal of Taibah
University Medical Sciences, 9*(3), 213-218.
doi:http://dx.doi.org/10.1016/j.jtumed.2014.01.004

Alsohime, F., Temsah, M.-H., Al-Eyadhy, A., Bashiri, F., Househ, M., Jamal, A., . . .

Amer, Y. (2019). Satisfaction and perceived usefulness with newly-implemented

Electronic Health Records System among pediatricians at a university hospital.

Computer Methods and Programs in Biomedicine, 169, 51-57.

doi:https://doi.org/10.1016/j.cmpb.2018.12.026

Ayaad, O., Alloubani, A., Abu ALhajaa, E., Farhan, M., Abuseif, S., Al Hroub, A., &

Akhu-Zaheya, L. (2019). The role of electronic medical records in improving the

quality of health care services: Comparative study. *International Journal of*

Medical Informatics, 127, 63-67.

doi:https://doi.org/10.1016/j.ijmedinf.2019.04.014

Balestra, M. (2017). Electronic Health Records: Patient Care and Ethical and Legal

Implications for Nurse Practitioners. *The Journal for Nurse Practitioners, 13*(2),

105-111. doi: https://doi.org/10.1016/j.nurpra.2016.09.010

Bani-issa, W., Al Yateem, N., Al Makhzoomy, I., & Ibrahim, A. (2016). Satisfaction of

health-care providers with electronic health records and perceived barriers to its

implementation in the United Arab Emirates. *International Journal of Nursing*

Practice, 22, 408–416. doi:https://doi.org/10.1111/ijn.12450

Baumann, L., Baker, J., & Elshaug, A. (2018). The impact of electronic health record

systems on clinical documentation times: A systematic review. *Health Policy,*

122(8), 827-836. doi:https://doi.org/10.1016/j.healthpol.2018.05.014

Bossen, C., Jensen, L. G., & Udsen, F. W. (2013). Evaluation of a comprehensive EHR

based on the DeLone and McLean model for IS success: Approach, results, and

success factors. *International Journal of Medical Informatics, 82*(10), 940-953. doi:https://doi.org/10.1016/j.ijmedinf.2013.05.010

Byrne, M., Fong, H., & Danks, J. (2017). A Survey of Perianesthesia Nursing Electronic Documentation. *Journal of PeriAnesthesia Nursing, 33*(2), 172-176. doi:https://doi.org/10.1016/j.jopan.2016.02.008

Cerner. (n.d.). Retrieved November 24, 2019, from Cerner: https://www.cerner.com/solutions/health-systems

Delone, W. H., & Mclean, E. R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems, 19*(4), 9-30. doi:DOI: 10.1080/07421222.2003.11045748

Despont-Grosa, C., Fabry, P., Mullera, H., Geissbuhlera, A., & Lovisa, C. (2004). User acceptance of Clinical Information Systems: A methodological approach to identify the key dimensions allowing a reliable evaluation framework. *Studies in health technology and informatics, 107*, 1038-42. doi:DOI: 10.3233/978-1-60750-949-3-1038

Dictionaries, O. L. (n.d.). Retrieved from https://www.oxfordlearnersdictionaries.com/

Dictionary, L. (n.d.). Retrieved October 25, 2019, from Lexico Dictionary: https://www.lexico.com/en

Dictionary, M. (n.d.). Retrieved October 19, 2019, from Medical Dictionary for the Health Professions and Nursing: https://medical-dictionary.thefreedictionary.com/

Dictionary, M.-W. (n.d.). Retrieved October 23, 2019, from Meriam-Webster Dictionary: https://www.merriam-webster.com/

Duarte, J. G., & Azevedo, R. S. (2017). Electronic health record in the internal medicine clinic of a Brazilian university hospital: Expectations and satisfaction of physicians and patients. *International Journal of Medical Informatics, 102*, 80-86. doi:https://doi.org/10.1016/j.ijmedinf.2017.03.007

Gray, J., & Siewiorek, D. P. (1991). High Availability Computer Systems . 39-48. Retrieved from https://research.cs.wisc.edu/areas/os/Qual/papers/ha-systems.pdf

Grout, R. W., Cheng, E. R., Carroll, A. E., Bauer, N. S., & Downs, S. M. (2018). A six-year repeated evaluation of computerized clinical decision support system user acceptability. *International Journal of Medical Informatics, 112*, 74-81. doi:https://doi.org/10.1016/j.ijmedinf.2018.01.011

Hadji, B., & Degoulet, P. (2016). Information system end-user satisfaction and continuance intention: A unified modeling approach. *Journal of Biomedical Informatics, 61*, 185-193. doi:https://doi.org/10.1016/j.jbi.2016.03.021

Hadji, B., Martin, G., Dupuis, I., Campoy, E., & Degoulet, P. (2016). 14 Years longitudinal evaluation of clinical information systems acceptance: The HEGP case. *International Journal of Medical Informatics, 86*, 20-29. doi:https://doi.org/10.1016/j.ijmedinf.2015.11.016

Hair, J., Black, W., Babin, B., & Anderson, R. (2014). *Multivariate Data Analysis* (7th ed.). Pearson.

Handayani, P. W., Hidayanto, A. N., & Budi, I. (2018). User acceptance factors of

    hospital information systems and related technologies: Systematic review.

    Informatics for Health and Social Care, 43(4), 401-426.

    doi:https://doi.org/10.1080/17538157.2017.1353999

Harris, D., Haskell, J., & Cooper, E. (2018). Estimating the association between burnout

    and electronic health record-related stress among advanced practice registered

    nurses. *Applied Nursing Research, 43*, 36-41.

    doi:https://doi.org/10.1016/j.apnr.2018.06.014

Hossain, A., Quaresma, R., & Rahman, H. (2019). Investigating factors influencing the

    physicians' adoption of electronic health record (EHR) in healthcare system of

    Bangladesh: An empirical study,. *International Journal of Information*

    Management, 44, 76-87. doi:https://doi.org/10.1016/j.ijinfomgt.2018.09.016

Hudson, D., Kushniruk, A., Borycki, E., & Zuege, D. (2018). Physician satisfaction with

    a critical care clinical information system using a multimethod evaluation of

    usability. *International Journal of Medical Informatics, 112*, 131-136.

    doi:https://doi.org/10.1016/j.ijmedinf.2018.01.010

Hwang, Y. (2014). User experience and personal innovativeness: An empirical study on

    the Enterprise Resource Planning systems. *Computers in Human Behavior, 34*,

    227-234. doi:https://doi.org/10.1016/j.chb.2014.02.002

Ifinedo, P. (2016). The moderating effects of demographic and individual characteristics

    on nurses' acceptance of information systems: A canadian study. *International*

Journal of Medical Informatics, 87, 27-35.

doi:https://doi.org/10.1016/j.ijmedinf.2015.12.012

Jackson, J. D., Yi, M. Y., & Park, J. S. (2013). An empirical test of three mediation
    models for the relationship between personal innovativeness and user acceptance
    of technology. *Information & Management, 50*(4), 154-161.
    doi:https://doi.org/10.1016/j.im.2013.02.006

Jensen, S., Kushniruk, A. W., & Nøhr, C. (2015). Clinical simulation: A method for
    development and evaluation of clinical information systems. *Journal of
    Biomedical Informatics, 54*, 65-76. doi:https://doi.org/10.1016/j.jbi.2015.02.002

Karimi, F., Poo, D., & Tan, Y. (2015). Clinical information systems end user satisfaction:
    The expectations and needs congruencies effects. *Journal of Biomedical
    Informatics, 53*, 342-354. doi:https://doi.org/10.1016/j.jbi.2014.12.008

Khalifa, M., & Alswailem, O. (2015). Hospital Information Systems (HIS) Acceptance
    and Satisfaction: A Case Study of a Tertiary Care Hospital. *Procedia Computer
    Science, 63*, 198-204. doi:https://doi.org/10.1016/j.procs.2015.08.334

Lin, Y.-K., & Yeh, C.-T. (2015). System reliability maximization for a computer network
    by finding the optimal two-class allocation subject to budget. *Applied Soft
    Computing, 36*. doi:https://doi.org/10.1016/j.asoc.2015.07.037

Luna, D. R., Rizzato Lede, D. A., Otero, C. M., Risk, M. R., & Bernaldo de Quirós, F. G.
    (2017). User-centered design improves the usability of drug-drug interaction
    alerts: Experimental comparison of interfaces. *Journal of Biomedical Informatics,*

66, Journal of Biomedical Informatics.

doi:https://doi.org/10.1016/j.jbi.2017.01.009

Marckini, D. N., Samuel, B. P., Parker, J. L., & Cook, S. C. (2019). Electronic health

record associated stress: A survey study of adult congenital heart disease

specialists. *Conginetal Heart Disease, 14*(5), 1-6. doi:DOI: 10.1111/chd.12745

Mohamadali, N. A., & Ab Aziz, N. F. (2017). The Technology Factors as Barriers for

Sustainable Health Information Systems (HIS) – A Review. *Procedia Computer

Science, 124*, 370–378. doi:https://doi.org/10.1016/j.procs.2017.12.167

Nazamul, H., Mohammad, M., & Chowdhury, A. (2019). Quality of Education in

Bangladesh: A Survey on Private Business Schools. Retrieved from

https://www.researchgate.net/publication/335758424_Quality_of_Education_in_

Bangladesh_A_Survey_on_Private_Business_Schools

Ologeanu-taddei, R., Morquin, D., & Vitari, C. (2016). Perceptions of an Electronic

Medical Record (EMR): Lessons from a French Longitudinal Survey. *Procedia

Computer Science, 100*, 100. doi:https://doi.org/10.1016/j.procs.2016.09.197

Osman, A., & Saputra, R. (2017). DETERMINANTS OF STUDENT SATISFACTION

IN THE CONTEXT OF HIGHER EDUCATION: A COMPLETE

STRUCTURAL EQUATION MODELING APPROACH. *British Journal of

Marketing Studies, 5*(6), 1-14. Retrieved from www.eajournals.org/wp-

content/uploads/Determinants-of-Student-Satisfaction-in-the-Context-of-Higher-

Education-A-Complete-Structural-Equation-Modeling-Approach.pdf

POLAT, C. (2015). HOW TO MEASURE THE CUSTOMER SATISFACTION
AMONG INTERNATIONAL STUDENTS? AN EXPLORATIVE CASE
STUDY ON UNIVERSITY STUDENTS. *Academic Review of Economics and
Administrative Sciences, 8*(2), 41-59. Retrieved from
https://dergipark.org.tr/en/download/article-file/185170

Rosen, P. A. (2005). THE EFFECT OF PERSONAL INNOVATIVENESS ON
TECHNOLOGY ACCEPTANCE AND USE. 1-93. Retrieved from
https://pdfs.semanticscholar.org/72dd/838836a261aae2a2c0e4dfb1f34ac871ec9d.
pdf

Schweitzer, M., Lasierra, N., & Hörbst, A. (2016). Requirements for Workflow-Based
EHR Systems – Results of a Qualitative Study. doi:doi:10.3233/978-1-61499-
645-3-124

Sebetci, Ö. (2018). Enhancing end-user satisfaction through technology compatibility: An
assessment on health information system. *Health Policy and Technology, 7*(3),
265-274. doi:https://doi.org/10.1016/j.hlpt.2018.06.001

Testing Assumptions of Linear Regression in SPSS. (n.d.). Retrieved Nov. 16th, 2019,
from Statistics Solutions: https://www.statisticssolutions.com/testing-
assumptions-of-linear-regression-in-spss/

Turana, A., Tunç, A. Ö., & Z. C. (2015). A Theoretical Model Proposal: Personal
Innovativeness and User Involvement as Antecedents of Unified Theory of
Acceptance and Use of Technology. *Procedia, 210*, 43 – 51. doi:doi:
10.1016/j.sbspro.2015.11.327

Wilbanks, B., Berner, E., Alexander, G., Azuero, A., Patrician, P., & Moss, J. (2018).
The effect of data-entry template design and anesthesia provider workload on
documentation accuracy, documentation efficiency, and user-satisfaction.
International Journal of Medical Informatics, 118, 29-35.
doi:https://doi.org/10.1016/j.ijmedinf.2018.07.006

Wu, T. (1987). Sequential estimation of computer system availability. *Mathematical
Modelling, 8*, 117-118. doi:https://doi.org/10.1016/0270-0255(87)90553-7

Yi, M. Y., Fiedler, K. D., & Park, J. S. (2006). Understanding the Role of Individual
Innovativeness in the Acceptance of IT-Based Innovations: Comparative
Analyses of Models and Measures. *Decision Sciences, 37*(3), 393-426.
doi:https://doi.org/10.1111/j.1540-5414.2006.00132.x

APPENDIX A: SURVEY INFORMED CONSENT

Consent Form for Online Survey

Dear Respondent,

We would like to invite you to participate in this research study titled (Clinical Information System: Measuring End User Satisfaction, The Case of Qatar). The study is approved by the Qatar University Institutional Review Board with the approval number (QU-IRB 1144-E/19); If you have any questions related to ethical compliance of the study you may contact them at (QU-IRB@qu.edu.qa). The study is also approved by Quality and Patient Safety (QPS) department in Al Wakra Hospital; if you have any questions related to administrative approval you may contact Head of QPS department, Mr Almunzer Zakaria, at (AZakaria@hamad.qa) or phone (4011-4310).

Hospitals have been using Clinical Information Systems (CIS) as a mean for communicating clinical information of patient care among healthcare providers which has led to improving overall patient care. CIS is based on information technology (IT) and is enhanced by improvements in IT. Nevertheless, CIS has continuously faced challenges to achieve optimal utilization due to level of end-user satisfaction. A literature review was conducted to explore factors affecting end-user satisfaction and concluded to the following constructs: information quality, system quality, service quality and professional maturity. The purpose of the study is to investigate factors affecting satisfaction of clinicians and administrative staff who use clinical information system in Al Wakra Hospital. Results can be used to optimize utilization of the clinical information system. There are no associated risks or harms to the participants. Rather, participants' opinions can turn positively on their experience with the clinical information system. This research is considered subjective. Data is collected using quantitative survey with structured set of questions. The information collected will be stored in a password protected safe inside supervisor's office number 424, building I-03. Only primary investigators will have access to the surveys.

The survey should not take more than 10 minutes of your time. The information collected will be kept strictly confidential. Your participation is completely voluntary and anonymous. If you would like to obtain the results of the study, you may provide your e-mail address at the end of the survey, however this is entirely optional. You may withdraw from this study at any time.
If you have any questions, you may contact project supervisor, Professor Emad Abu Shanab, College of Business and Economics, Qatar University, via email (eabushanab@qu.edu.qa), phone (4403-5077) or mobile (6647-8297).

Please indicate that you have read, understood and   agree to participate. If you wish to participate, kindly select (Yes)

Yes   NO

Participant's email to receive results
(optional)

_____

Thank you for your valuable time.

Consent Form for Hardcopy Survey

Dear Respondent,

We would like to invite you to participate in this research study titled (Clinical Information System: Measuring End User Satisfaction, The Case of Qatar). The study is approved by the Qatar University Institutional Review Board with the approval number (QU-IRB 1144-E/19); If you have any questions related to ethical compliance of the study you may contact them at (QU-IRB@qu.edu.qa). The study is also approved by Quality and Patient Safety (QPS) department in Al Wakra Hospital; if you have any questions related to administrative approval you may contact Head of QPS department, Mr Almunzer Zakaria, at (AZakaria@hamad.qa) or phone (4011-4310).

Hospitals have been using Clinical Information Systems (CIS) as a mean for communicating clinical information of patient care among healthcare providers which has led to improving overall patient care. CIS is based on information technology (IT) and is enhanced by improvements in IT. Nevertheless, CIS has continuously faced challenges to achieve optimal utilization due to level of end-user satisfaction. A literature review was conducted to explore factors affecting end-user satisfaction and concluded to the following constructs: information quality, system quality, service quality and professional maturity. The purpose of the study is to investigate factors affecting satisfaction of clinicians and administrative staff who use clinical information system in Al Wakra Hospital. Results can be used to optimize utilization of the clinical information system. There are no associated risks or harms to the participants. Rather, participants' opinions can turn positively on their experience with the clinical information system. This research is considered subjective. Data is collected using quantitative survey with structured set of questions. The information collected will be stored in a password protected safe inside supervisor's office number 424, building I-03. Only primary investigators will have access to the surveys.

The survey should not take more than 10 minutes of your time. The information collected will be kept strictly confidential. Your participation is completely voluntary and anonymous. If you would like to obtain the results of the study, you may provide your e-mail address at the end of the survey, however this is entirely optional. You may withdraw from this study at any time.

If you have any questions, you may contact project supervisor, Professor Emad Abu Shanab, College of Business and Economics, Qatar University, via email (eabushanab@qu.edu.qa), phone (4403-5077) or mobile (6647-8297).

Please indicate that you have read, understood and agree to participate. If you wish to participate, kindly select (Yes) and put your signature

Yes   NO

Participant's signature   Participant's email to receive results
                                                          (optional)_____
_____

Thank you for your valuable time.

                                                          Researcher's Signature_____
                                                          Date_____

APPENDIX B: SURVEY QUESTIONNAIRE

Clinical Information System: Measuring End User Satisfaction
The Case of Qatar
Survey

Dear participant:

This survey was developed to determine satisfaction levels of healthcare providers using CIS in Qatar. Survey is composed of two sections: first section composes demographic questions and second section composes questions about the study variables.

It is expected not take more than 10 minutes to complete the survey. Having accurate answers will help develop right conclusions. Participation in this survey is anonymous to protect your confidentiality and it will not be used except for research purposes. Participation is voluntary and you may decide not to answer any questions or withdraw your participation at any time. Your answers will not be used for any official purposes.

Thank you for sharing your opinion (Note, CIS = Clinical Information System)

Prof. Emad Abu Shanab **Mr. Moatasem Al-Hasson**
College of Business & Economics – Qatar University

Section 1: General Information

Gender: ☐ Male ☐ Female

Age (in years): ☐ 20-30 ☐ 31-40 ☐ 41-50 ☐ 51+

Education: ☐ Diploma ☐ Bachelor ☐ Master ☐ PhD

Profession: ☐ Physician ☐ Nurse ☐ Pharmacist

Experience in profession (in years):
☐ 1-2 ☐ 3-5 ☐ 6-10 ☐ 11+

Experience in using CIS (in years):
☐ 1-2 ☐ 3-5 ☐ 6-10 ☐ 11+

Computer skills: ☐ Basic ☐ Sufficient ☐ Moderate
☐ Advanced ☐ Very advanced

Section 2: Following questions relate to the variables affecting end-user satisfaction of CIS. Kindly select the number that best meets your opinion using the following scale meaning:

1 = Strongly Disagree ➡ 5 = Strongly Agree

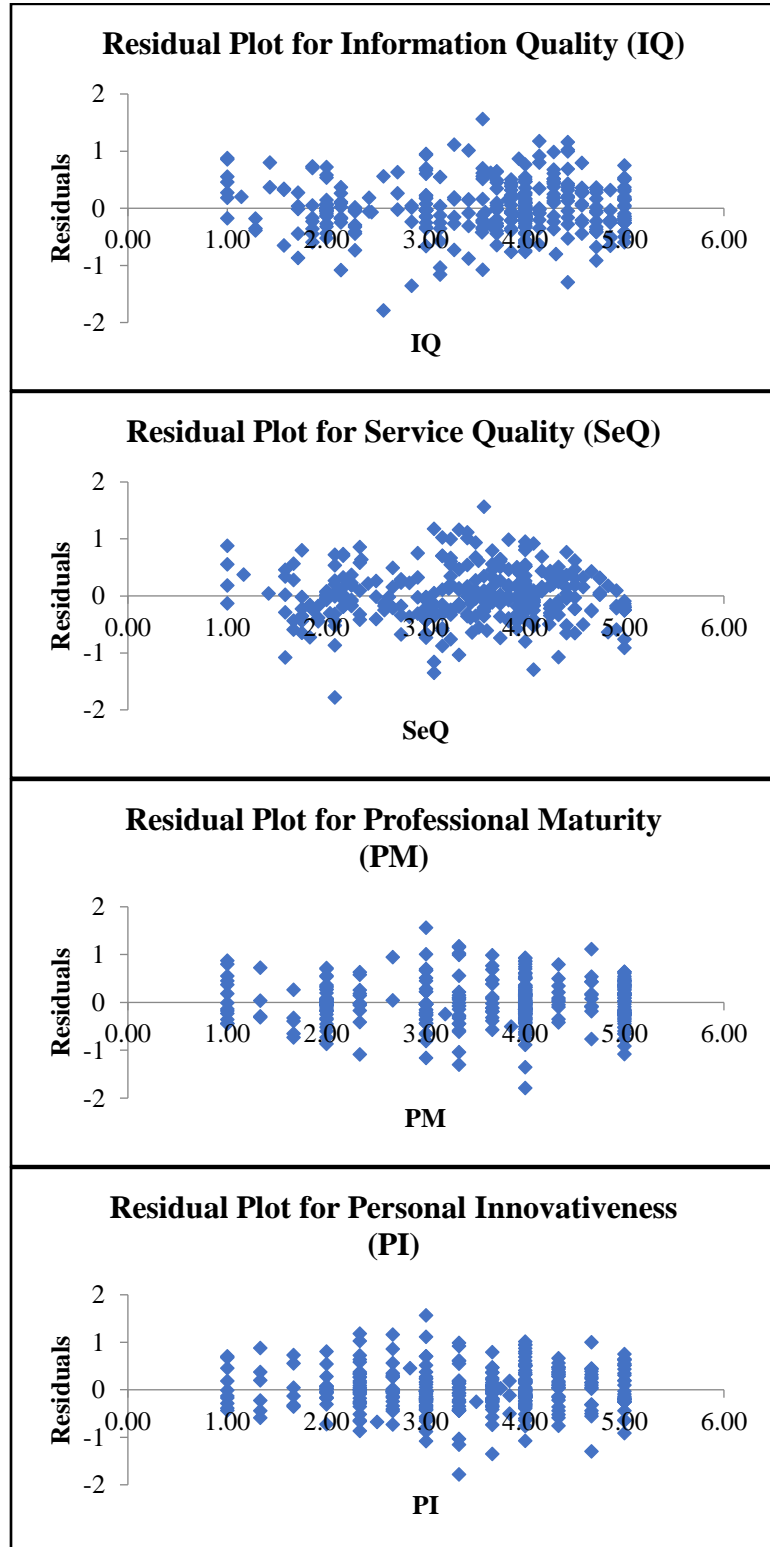|	Information Quality	1	2	3	4	5
1	CIS content meets my needs					
2	CIS provides complete information					
3	Information provided in CIS is accurate					
4	CIS information is credible					
5	Information from CIS is relevant to the tasks and decisions I take					

		1	2	3	4	5
6	CIS contains up-to-date information					
7	Information stored in the system is protected					
	System Quality	**1**	**2**	**3**	**4**	**5**
8	CIS provides personalized information					
9	CIS addresses my personal needs					
10	Time required to access information in CIS is appropriate for me					
11	CIS interface is usable for completing my work					
12	CIS is an easy-to-use system					
13	I don't need help when using CIS					
14	The system is always available for me to use					
15	Accessing the system is convenient for me (24x7)					
16	I can depend on the system to complete my work					
17	I find the system to be flexible to interact with					
	Service Quality	**1**	**2**	**3**	**4**	**5**
18	Hamad IT department provides sufficient support for CIS users					
19	Hamad IT department provides prompt service for CIS users					
20	Hamad IT personnel have the knowledge to do their job					
21	Hamad IT personnel are supportive					
22	The chain of command with IT department is efficient and suitable					
23	Vendor support to advanced CIS pitfalls is suitable					
24	Top management provides all resources needed					
25	Top management supports all needed training for users					
26	Hardware used for CIS is the latest in the field					
27	Software and add-ons used in HMC is new and always get updated					
28	Downtime occurrences negatively impact flow of work					
29	Downtime, when happens, is not solved efficiently					
	Professional Maturity	**1**	**2**	**3**	**4**	**5**
30	My level of Education positively supports the effective use of CIS					
31	My professional experience supports the effective use of CIS					
32	My training provided by HMC supports the effective use of CIS					
	Personal Innovativeness	**1**	**2**	**3**	**4**	**5**
33	If I heard about a new information system, I look for ways to use it					
34	Among my peers, I am the first to try out new information technologies					
35	I like to experiment with new information technologies					
	Satisfaction	**1**	**2**	**3**	**4**	**5**
36	I recommend using CIS to others					
37	CIS has met my expectations					
38	I feel comfortable while using CIS					
39	Overall, I am satisfied with CIS					

Would you add any comment: _____

APPENDIX C: SCALE RELIABILITY STATISTICS

Code	Item	Cronbach's Alpha	Cronbach's Alpha if Item Deleted
Information Quality (IQ)		**0.930**	**-**
IQ1	CIS content meets my needs		
IQ2	CIS provides complete information		
IQ3	Information provided in CIS is accurate		
IQ4	CIS information is credible		
IQ5	Information from CIS is relevant to the tasks and decisions I take		
IQ6	CIS contains up-to-date information		
IQ7	Information stored in the system is protected		
System Quality (SyQ)		**0.921**	**-**
SyQ1	CIS provides personalized information		
SyQ2	CIS addresses my personal needs		
SyQ3	Time required to access information in CIS is appropriate for me		
SyQ4	CIS interface is usable for completing my work		
SyQ5	CIS is an easy-to-use system		
SyQ6	I don't need help when using CIS		
SyQ7	The system is always available for me to use		
SyQ8	Accessing the system is convenient for me (24x7)		
SyQ9	I can depend on the system to complete my work		
SyQ10	I find the system to be flexible to interact with		
Service Quality (SeQ)		**0.931**	**-**
SeQ1	Hamad IT department provides sufficient support for CIS users		
SeQ2	Hamad IT department provides prompt service for CIS users		
SeQ3	Hamad IT personnel have the knowledge to do their job		
SeQ4	Hamad IT personnel are supportive		
SeQ5	The chain of command with IT department is efficient and suitable		
SeQ6	Vendor support to advanced CIS pitfalls is suitable		
SeQ7	Top management provides all resources needed		
SeQ8	Top management supports all needed training for users		
SeQ9	Hardware used for CIS is the latest in the field		
SeQ10	Software and add-ons used in HMC is new and always get updated		
SeQ11	Downtime occurrences negatively impact flow of work		
SeQ12	Downtime, when happens, is not solved efficiently		
Professional Maturity (PM)		**0.933**	**-**
PM1	My level of Education positively supports the effective use of CIS		
PM2	My professional experience supports the effective use of CIS		
PM3	My training provided by HMC supports the effective use of CIS		
Personal Innovativeness (PI)		**0.821**	**-**
PI1	If I heard about a new information system, I look for ways to use it		
PI2	Among my peers, I am the first to try out new information technologies		
PI3	I like to experiment with new information technologies		
Satisfaction (S)		**0.954**	
S1	I recommend using CIS to others		
S2	CIS has met my expectations		
S3	I feel comfortable while using CIS		
S4	Overall, I am satisfied with CIS		

APPENDIX D: RESIDUAL PLOT FOR INDEPENDENT VARIABLES

Residual Plot for Information Quality (IQ)

Residual Plot for Service Quality (SeQ)

Residual Plot for Professional Maturity (PM)

Residual Plot for Personal Innovativeness (PI)

APPENDIX E: AUTHOR BIOGRAPHY

Moatasem Al-Hasson was born in Kuwait in 1981. He completed his school and university studies in his original country in Jordan. He is a nurse by background and completed his bachelor's degree in nursing science in 2005. After that, he worked as a registered nurse in a semi-governmental hospital. In 2012, he started his experience in nursing management as a charge nurse in Qatar in Al Wakra Hospital operating room. After two years, he started doing as Head Nurse of same unit till now.

He is interested in quality improvement initiatives. He participated in multiple projects and now responsible to manage operating room, post-anesthesia care unit and day care surgery with more than one hundred employees under his direct management.

He is ambitious and plans to further advance his career pathway and have more effective role in quality improvement projects. Hence, he enrolled in MBA in Qatar University. As he is hard-worker and cares about time, he is going to complete his degree by mid of December 2019 instead of the following semester.