

**The impact of electronic health information systems on improving
the quality of health services in government hospitals in the
Kingdom of Saudi Arabia**

By

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Dedication

Acknowledgment

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Chapter one

Introduction

1.1 Introduction

Having a good and suitable information system is one of the most important factors determining the success or failure of any department in achieving its goals efficiently and effectively (Sheikh et al., 2021). Therefore, all organizations want to have a good computer-based information system because computer-based information technology has become the primary means of transferring, exchanging, and processing data within most organizations (Hussein et al., 2023).

The importance of information and its systems is increasing because it is a strategic resource for most business organizations in the modern information society. It provides the necessary support to achieve competitive advantages that contribute to strengthening the organization and its success. This is not achieved automatically; rather, it requires organizations to work on developing the necessary information systems (Modi & Feldman, 2022).

The healthcare sector has witnessed rapid digital transformation as a result of significant advancements in information technology, with electronic health information systems becoming a cornerstone in improving the quality of healthcare (Kumari & Chander, 2024). These systems contribute to improving the accuracy of medical data, reducing errors, and enhancing the efficiency of healthcare processes, which directly impacts the quality of healthcare services

provided. They also play a pivotal role in supporting decision-making by providing accurate and timely information that helps physicians and administrators make effective decisions.

In this context, the views, interests, and meanings of healthcare stakeholders vary, and the quality of healthcare services, given their intangible nature, depends on the service delivery process and the interactions between patients and healthcare providers (Endeshaw, 2021). In Saudi Arabia, the healthcare sector is experiencing remarkable development within the framework of Vision 2030, which aims for digital transformation and improving the quality of healthcare services. Despite this progress, challenges remain in effectively implementing these systems and realizing their full potential (Suleiman & Ming, 2025).

1.2 Problem statement

Electronic health information systems and related digital health information infrastructures are increasingly deployed to strengthen healthcare quality (Ştefan et al., 2024). In the Kingdom of Saudi Arabia, government hospitals operate within a rapidly evolving national digital health agenda, where standardized data capture, interoperability among clinical units, and timely information availability are intended to improve clinical processes and service outcomes (AlWatban et al., 2024). The research problem centers on understanding how these systems influence measurable dimensions of quality, including care coordination, continuity of documentation, patient safety practices, and the reliability of clinical and administrative workflows.

From a scientific and operational perspective, the quality of health services is influenced by the extent to which electronic systems improve information completeness, reduce delays, support consistent clinical documentation, and enhance the accessibility of patient histories across departments. However, the effect of electronic health information systems is not automatic; it depends on implementation fidelity, usability, training adequacy, system performance, governance mechanisms, and the degree of integration with existing hospital processes (Alharbi, 2025). In government hospitals—often characterized by high patient volumes, complex administrative structures, and multi-disciplinary care pathways—the interplay between technology and organizational workflow becomes central to evaluating whether information system capabilities translate into sustained service quality improvements.

Despite increased attention to digital transformation in healthcare, there remains a gap in context-specific evidence that directly links electronic health information system use within Saudi government hospitals to empirically assessed service quality outcomes, while accounting for implementation realities unique to these institutions. In particular, existing studies may emphasize generalized technology benefits, focus narrowly on system adoption or infrastructure readiness, or rely on limited measures that do not fully capture multi-dimensional quality effects. Consequently, there is a need for rigorous research that evaluates how electronic health information systems shape service quality in practice—considering variations in workflow integration, staff capabilities, and organizational support—so that findings can be translated into actionable guidance for Saudi government hospital improvement efforts.

Accordingly, the research problem can be framed as an empirical inquiry into the relationship between the characteristics and implementation of electronic health information

systems and hospital service quality in Saudi government settings. The overarching aim is to generate evidence that can inform implementation strategies, resource allocation, and policy decisions for digital health in Saudi hospitals.

1.3 Research Questions

The main question of this study is as follows:

“Is there an impact of electronic health information systems on improving the quality of health services in government hospitals in the Kingdom of Saudi Arabia?”

The following sub-questions stem from this main hypothesis:

1. Is there an impact of electronic health information systems on tangibles in government hospitals in the Kingdom of Saudi Arabia?
2. Is there an impact of electronic health information systems on reliability in government hospitals in the Kingdom of Saudi Arabia?
3. Is there an impact of electronic health information systems on responsiveness in government hospitals in the Kingdom of Saudi Arabia?
4. Is there an impact of electronic health information systems on assurance in government hospitals in the Kingdom of Saudi Arabia?
5. Is there an impact of electronic health information systems on empathy in government hospitals in the Kingdom of Saudi Arabia?

1.4 Research Objectives

The objectives of this study are as follows:

1. To determine the level of electronic health information systems in government hospitals in the Kingdom of Saudi Arabia.
2. To determine the level of quality of health services in government hospitals in the Kingdom of Saudi Arabia.
3. To identify the dimensions of quality of health services in government hospitals in the Kingdom of Saudi Arabia, namely (Tangibles, Reliability, Responsiveness, Assurance, and Empathy).
4. To identify the dimensions of electronic health information systems in government hospitals in the Kingdom of Saudi Arabia, namely (financial investment, legislation, staff training, political leadership, acceptability of technology).
5. To examine the impact of electronic health information systems on the quality of health services in government hospitals in the Kingdom of Saudi Arabia.

1.5 Research Significance

1.5.1 Theoretical Significance

Theoretically, studying the impact of electronic health information systems on service quality in Saudi government hospitals contributes to strengthening explanatory frameworks that link information management to healthcare quality. The problem is grounded in the idea that

clinical and administrative information—when accurately captured, structured, and promptly available—can improve continuity of care, coordination across departments, and the consistency of clinical documentation. Investigating these mechanisms helps clarify how information quality and process changes mediate the relationship between system characteristics and observed quality outcomes.

Additionally, the topic supports development and testing of context-sensitive models of technology–organization fit. Hospital environments differ in governance arrangements, staffing patterns, patient throughput, and decision-making processes; therefore, theoretical claims about electronic systems must be evaluated under local institutional conditions. Research can also refine conceptual distinctions among adoption, effective use, and realized service quality effects—offering clearer criteria for interpreting why some implementations yield measurable gains while others produce limited or variable improvements.

1.5.2 Practical importance

Practically, the findings can guide hospital leaders and policymakers in selecting, implementing, and scaling electronic health information systems to achieve concrete improvements in service quality. Evidence on which system features (e.g., standardized documentation workflows, timely information retrieval, and integration across clinical units) most strongly relate to quality indicators can inform procurement decisions, system customization priorities, and implementation strategies. This is particularly relevant for government hospitals, where resources, governance procedures, and operational constraints require careful alignment between digital investments and quality improvement objectives.

Moreover, the research can support workforce planning and operational governance by identifying the organizational conditions necessary for sustained benefits. If service quality improvements depend on factors such as workflow redesign, staff training effectiveness, and data governance practices, then practical interventions can be designed accordingly. The results can also help establish performance measurement approaches for monitoring quality after implementation, enabling continuous improvement through targeted remediation of bottlenecks and systematic evaluation of outcomes for both clinical care and patient experience.

1.6 Research Hypotheses

The main hypothesis of this study is as follows:

H1. There is a statistically significant impact of electronic health information systems (financial investment, legislation, staff training, political leadership, acceptability of technology) on improving the quality of health services in government hospitals in the Kingdom of Saudi Arabia at level ($\alpha \leq 0.05$).

The following sub-hypotheses stem from this main hypothesis:

H1.1 There is a statistically significant impact of electronic health information systems on tangibles in government hospitals in the Kingdom of Saudi Arabia at level ($\alpha \leq 0.05$).

H1.2 There is a statistically significant impact of electronic health information systems on reliability in government hospitals in the Kingdom of Saudi Arabia at level ($\alpha \leq 0.05$).

H1.3 There is a statistically significant impact of electronic health information systems on responsiveness in government hospitals in the Kingdom of Saudi Arabia at level ($\alpha \leq 0.05$).

H1.4 There is a statistically significant impact of electronic health information systems on assurance in government hospitals in the Kingdom of Saudi Arabia at level ($\alpha \leq 0.05$).

H1.5 There is a statistically significant impact of electronic health information systems on empathy in government hospitals in the Kingdom of Saudi Arabia at level ($\alpha \leq 0.05$).

1.7 Research model

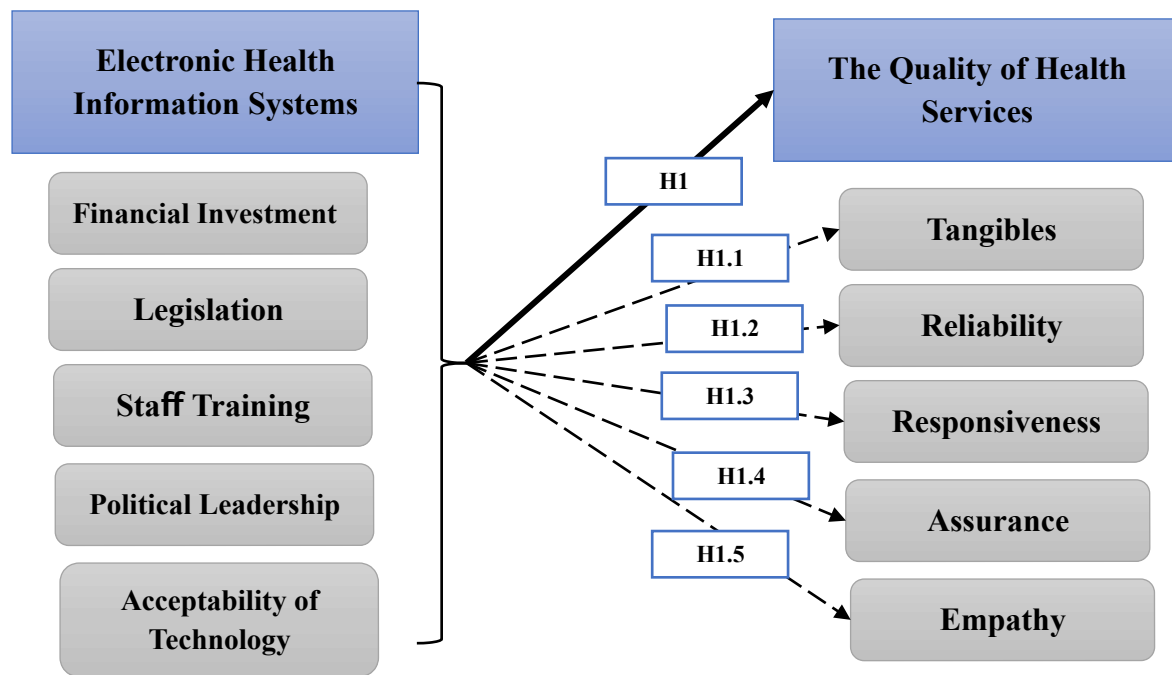


Figure (1.1): Research model, Prepared by the researcher with reference to (Goula et al., 2021; Gatiti et al., 2021; Khubone et al., 2020)

1.8 Study Limitations

- **Objective Limitations:** This study focuses on investigating the variables of electronic health information systems and improving the quality of healthcare services.
- **Human Limitations:** This study is applied to employees in Saudi Arabian government hospitals.
- **Geographical Limitations:** The study focuses on government hospitals in the Eastern Province of Saudi Arabia.
- **Temporal Limitations:** This study is conducted during the 2026/2027 academic year.

Chapter Two

Literature Review

2.1 Introduction

Electronic health information systems (EHIS) are widely treated as socio-technical tools that can shape how healthcare organizations capture, manage, and use clinical and administrative information. In government hospitals in the Kingdom of Saudi Arabia, the quality of health services represents a multidimensional outcome typically reflected in aspects. Consequently, the relationship between EHIS and service quality can be conceptualized as a process in which the system's adoption and effective use influence information availability, clinical decision-making, care coordination, and continuity of services. Within this context, the

present study draws on the Technology Acceptance Model (TAM) to explain how users' technology-related perceptions affect their intentions and behavior toward using EHIS, and how those utilization patterns are expected to translate into improvements in service quality.

TAM provides a parsimonious and well-validated theoretical basis for examining technology adoption by emphasizing perceived usefulness and perceived ease of use as central determinants of users' behavioral intention and subsequent system use. In healthcare settings, perceived usefulness may relate to whether EHIS is seen as improving clinical workflow efficiency, decision support, and documentation quality, while perceived ease of use reflects how usable, learnable, and compatible the system is with daily tasks and institutional procedures. Prior empirical studies in hospital environments indicate that higher perceived usefulness and ease of use are associated with stronger intentions to use electronic systems and more consistent utilization, which in turn can support better coordination of care, reduced documentation errors, and improved access to timely information. Therefore, TAM is used in this study to frame EHIS adoption and use as the mechanism linking individual perceptions of EHIS to organizational-level outcomes in the form of improved quality of health services.

This chapter presents information about the two variables and the TAM model, in addition to a presentation of a group of previous studies related to the topic of the current study.

2.2 Electronic Health Information Systems

2.2.1 The Concept of Electronic Health Information Systems

An effective healthcare system plays a vital role in striving for better health outcomes (Butkus et al., 2020). A robust health information system (HIS) impacts the effectiveness of health systems. A sound HIS enables the smooth flow of information to those who need it in a timely manner. An effective HIS can also contribute to policymaking by providing managers and other policymakers with the information, data, and knowledge they need to make objective and informed decisions (Nguyen et al., 2020). Furthermore, an HIS can improve transparency and accountability by enhancing access to information at all times. When using an HIS, reports can be generated instantly, facilitating the tracking of decisions, funding, and even recommendations (Musen et al., 2021).

eHealth, a concept that leverages technology to monitor various health conditions, has become a central focus in the development of healthcare strategies and policies. Originally emerging in 1999 as a combination of electronic communications and technological advancements (Kovačić et al., 2022), eHealth has since evolved to encompass the integration of diverse internet technologies to enhance the quality of healthcare services (Kesse-Tachi et al., 2019).

The World Health Organization (2016) defines e-health as the cost-effective and safe use of information and communication technologies to support health and related fields, including healthcare services, monitoring, publications, education, knowledge, and research. Kovačić et al. (2022) define it as a multidisciplinary field that links medical information

technology, public health, and the business sector, facilitating the delivery of improved public health services via the internet and related technologies.

The growing interest in information and its systems stems from their strategic importance to most organizations in the information society. Information systems provide the necessary support to foster competitive advantages, strengthening an organization's position and ensuring its continuity and success. Therefore, this discussion will explore the most important aspects of health information systems (Ştefan et al., 2024).

Epizitone et al. (2023) defined an information system as a set of procedures that collect, retrieve, process, and store information to support decision-making, coordination, and control. Information systems can assist managers and employees in analyzing problems, developing existing products, and creating new ones.

There are several definitions of an electronic health information system. Pai et al. (2021) defined it as a system that provides medical information to beneficiaries of the health system, helping them enter, maintain, and review information, generate statistics, and make decisions. Shojaei et al. (2024) defined it as a set of comprehensive and integrated computerized systems designed to store, process, distribute, and utilize information related to the health field. Al-Elkefi & Asan (2022) defined it as a system that manages and monitors medical activities within a health institution and provides all administrative and treatment services to patients, physicians, and related departments.

The shift to electronic health information systems is associated with numerous benefits. Firstly, nurses no longer have to struggle with illegible doctor handwriting or colleagues' documentation, improving the quality of nursing documentation (Al-Yasin & Alharbi, 2026).

This, in turn, can reduce medical errors resulting from misinterpretations of instructions. With electronic health records containing all the patient's essential information, nurses have access to everything they need to provide high-quality care.

Transferring medical records between different healthcare facilities has also become much easier. Since medical errors can be avoided, this also contributes to improved patient safety. Patient safety is defined as "preventing harm to patients while they are receiving the care intended to help them (Torab-Miandoab et al., 2023)." Financially, electronic health information systems reduce the cost of repeated diagnostic and laboratory tests, as all information can be easily retrieved from the patient's record (Rabbani et al., 2023).

2.2.2 The dimensions of Electronic Health Information Systems

Enablers of EHIS implementation are aligned with leadership abilities, sound policy decisions, and financial support, along with the goals of purchasing IT, connectivity, and capacity building. These enablers include: legislation, financial investment, staff training, political leadership, technology acceptance, performance expectancy, and social influence among professionals (Khubone et al., 2020).

- Financial Investment: Many low- and middle-income countries support financial investment to help expand electronic health information systems.

- Legislation: The responsibility for implementing electronic health information systems in public sector facilities lies with regional health departments, while policy development is the

responsibility of the National Ministry of Health. The National Ministry of Health is also responsible for facilitating and coordinating health information.

- Staff Training: There is growing evidence of the importance of having qualified health informatics personnel, and on-the-job training has been shown to improve performance through timely and intensive reporting of key health indicators.

- Political Leadership: Effective leadership can positively contribute to the successful adoption of a new electronic health information system in any organization.

- Technology acceptance: Research has shown that factors such as computer literacy, knowledge of electronic medical records, and educational level can influence the level of use of electronic health information systems.

2.3 Quality Of Health Services

Organizations of all kinds seek to prove their existence by providing their best services, so that these services exceed the expectations of the beneficiaries, meet their needs, and achieve their satisfaction. Poor service is achieved when the beneficiary's expectations of the service exceed his actual awareness of it, and distinguished service that is achieved when the actual performance of the service exceeds his previous expectations (Wulandari et al., 2024).

The name Quality of Service is a combination of two words, including service and quality. Service refers to the essential features of a particular service, while quality refers primarily to using a user-centered approach (Ramos et al., 2021). Together with quality of service, quality refers to the value of service to the customer. In addition, based on the service

quality model, Greenrooms believes that service quality is a combination of technical and functional, where functional service quality refers to the customer's service receiving specification and technical service quality refers to what the customer receives. New movements and scopes of work require a wide range of customers in Explore customer satisfaction and trust. This means that customers are very essential and vital in the field of business, so each business area requires performing its function properly in order to create trust between its products and customer trust, as many researchers believe that there is a good or strong relationship between service quality and customer trust (Ali et al., 2021).

2.3.1 Concept of Quality of Services

The quality of service is defined as the extent to which the service provided meets the expectations of the beneficiaries, and it is determined according to the perception of the beneficiary and not the perceptions of the service providers. So, the needs and requirements of the beneficiaries must be identified, then the service is designed to meet these requirements, and the quality of service can help the organization to distinguish itself from other organizations (O’Kane et al., 2021).

Quality of service can be interpreted as a thorough customer assessment of a certain service and the degree to which it fulfills their needs and leaves them satisfied. Concisely, service quality refers to how well an organization meets or exceeds its clients' expectations. The definition of good customer service, according to researchers, is when the fulfillment of customer needs may be coordinated, matched, or trumped by other considerations (Jonkisz et al., 2021).

The quality of service relates to the existence of a relationship between the benefits actually achieved from the use of the service and the desired benefits, and it is related to the degree of conformity of consumers' expectations with the extent of their awareness of the services actually provided (Ferreira et al., 2023). The quality of services also expresses the extent to which the expectations of the beneficiary are met, i.e., the match between what he hopes to receive and the actual performance of the organization in all stages and aspects of providing the service. It is also considered one of the determinants of the beneficiary's satisfaction. It considers conformity with the specifications set for providing the service from the point of view of the beneficiary, which is conformity with his needs (Bakhit, 2022).

2.3.2 Importance of quality of service

There is no doubt that the quality of service is an expression of the consumer's viewpoint or feeling toward the service received, and what the researchers disagreed on were the variables that result in that feeling as well as how to measure it, which resulted in the emergence of many methods and methods for measuring the quality of service. Although these methods agree that the measurement of service quality stems from the consumer, they differ in the manner in which they are conducted. They also highlighted the controversy over the dimensions that fall within the process of measuring service quality (Bakhit, 2022).

Several key indicators can be used to determine the importance of quality in public services, particularly health care. The most prominent of these indicators are the following (Ayadi, 2019):

1. Service was largely associated with quality, so it became necessary to adopt a number of measures to indicate the level of satisfaction achieved by patients by linking the service provided with quality.
2. Quality has four major dimensions that are adopted as a basis for measuring and influencing its level, which are tangibility, reliability, responsiveness, and safety.
3. Quality in health services is an important indicator in measuring the patient's level of satisfaction with the service provided to him by the hospital or any other health organization.
4. Quality in the health service is subject to continuous improvement through a specialized department within the organizational structure of the hospital, aiming to achieve comprehensiveness and integration in performance.

2.3.3 Dimensions of quality of service

The increasing need for services has emerged, so there are organizations based on providing services as desired by their pioneers. To measure the quality of the services provided, the organization follows the study of customer satisfaction. Measuring the extent to which their needs and desires are met, in an effort to achieve their requirements within the culture they adopt and their behavior towards the service provided, forcing Organizations need to develop their services according to the desires, needs, and expectations of customers. In addition, to measure the quality of service, the basic dimensions of service quality are addressed, which are as follows (Ali et al., 2021).

Most of the researchers agreed on the dimensions of service quality, which were tangible, reliability, responsiveness, efficiency, courtesy, credibility, security, access, communication, and understanding of the customer. There has recently been an increase in the number of researchers interested in developing service quality as a tool in organizations. Service quality is a multidimensional construct. Most researchers used the service quality model in order to measure service quality and customer satisfaction in organizations. The quality of service in the service quality model consists of Five dimensions: Tangibles, Reliability, Responsiveness, Assurance, and Empathy (Sugiarto & Octaviana, 2021).

- **Tangibility:**

The tangible is the basic characteristic that distinguishes the service from the product: its intangibility, that is, the fact that it cannot be touched or seen, and it needs to be strengthened so that the customer realizes it. On the other hand, organizations must find methods to provide a service of high quality, the quality cannot be assessed before consuming the service, and this constitutes the intangible. An impediment to customers recognizing the quality of service, because customers typically base their purchase decision on the reputation of the service provider and the importance of the mental image in the services provided (Chayomchai & Chanarpas, 2021).

- **Reliability:**

Reliability means organizations get a service right the first time. Moreover, it shows that organizations strive to deliver on promises and care about results (Pakurár, et, al., 2019).

Reliability is defined as the service provider's ability to fulfill and adhere to provide a service with reliability, stability, and accuracy in a reliable manner, such as the service of educational records as well as appointment procedures and solutions, and it expresses accuracy in the completion and approval of the service (Preaux et al., 2023).

- **Responsiveness:**

Responsiveness means the ability of the service provider to quickly respond. In addition, the achievement of responding by the service provider to the requests and inquiries of the service recipient, as it focuses on kindness and courtesy as well as responding to their inquiries and complaints, and the response is the provision of services to the recipient so that it is immediate (Alharbi & Aloyuni, 2023).

- **Assurance**

This refers to the knowledge and courtesy of service providers, their ability to inspire trust and confidence, and the trust patients place in doctors and hospital staff, based on their qualifications and capabilities (Abdullah et al., 2023). It is also called assurance, which refers to the attributes of knowledge, ability, and confidence that staff possess in providing service. Criteria for evaluating healthcare quality within this dimension include: the hospital's reputation and standing; the distinguished knowledge and skill of doctors and nursing staff; and the personal qualities of the staff. Assurance encompasses the knowledge and good treatment of service users by providers, their ability to foster trust and honesty, and both verbal and written communication between service providers and patients (Endeshaw, 2021). Assurance includes the following elements: a trustworthy and reliable hospital; a qualified and competent doctor; and courteous and kind hospital staff.

- **Empathy**

This aspect refers to the healthcare provider's attitudes and feelings towards patients during care services. Attitude means a commitment to understanding and helping patients, as well as personalizing the interaction with patients by showing concern and interest. It also indicates the importance of the medical staff's ability to identify the patient's condition during treatment as an indicator of their personal concern for the patient. The foundation of emotional interaction is reaching the patient through a personal relationship that makes the attention requested understandable, allowing the patient to feel their problems and work towards finding solutions (Moya-Salazar et al., 2023).

2.3.4 Measure the quality of service

Measuring the quality of services in organizations that focus on customer satisfaction and requirements is vital, and the process of measuring service quality in service organizations provides many advantages, perhaps the most important of which is knowledge of what customers need and whether the measures taken by the service organization are appropriate for them or not. In addition to knowing individuals from service providers with high performance rates and those with low performance, and determining what is good and what is bad with regard to the service organization and its customers, which helps to reach a balance between the interests of each of the two parties and achieve continuous improvement (Luong & Park, 2022).

In order to achieve quality in providing services, it is important to follow the following (Zain El Din et al., 2020):

- Attracting the attention of customers and arousing their interest, as attracting the attention of customers through the service provider is done through the positive attitudes that he shows. Mentally and psychologically preparing to meet customers and effective positive behavior are all behaviors that stimulate the positive desire of customers in order to obtain the service.
- Creating positive desire among customers and identifying their needs.
- Discussing with the client and reviewing his objections. It is desirable for the service provider to be interested in the client and take care of his objections in a diplomatic manner.
- Preserving the company's customers and the continuity of their dealings with the organization. Customer loyalty comes through some sales and marketing services, which constitute a guarantee of customer loyalty.

2.4 Technology Acceptance Model (TAM)

Many innovative information systems, along with their inherent complexities and difficulties in use, hinder the end user. Users often struggle to adapt to these new and complex technologies when implementing them in organizations or replacing older systems with more modern ones. Consequently, these technologies fail to achieve their intended goal of maximizing competitiveness (Nazir & Khan, 2024). The weak acceptance of these systems is

attributed to the development of a crucial model that determines the user's ability to accept and use these new technologies. This model is known as the Technology Acceptance Model (TAM) (Kamal et al., 2020).

This model is based on two fundamental elements: expected utility and ease of use. Developed by Davis (1985), it posits that individuals' acceptance of information systems is determined by two key variables: expected utility and expected ease of use (Aji & Ramadani, 2024). When a user believes that using a particular system will enhance and guarantee their career development, this becomes a significant factor in increasing the acceptance of any new system, leading to the adoption of examples of this new technology. This is complemented by the other element (ease of use). This results in a faster understanding of new systems, giving the user a sense of satisfaction, as they will not encounter complexities that might hinder their daily work (Badda, 2025). This positively impacts work performance and maximizes the benefit derived from the system. It should be noted that the failure of new systems is often due to users' reluctance to use them, either because they do not see a desired benefit in using them, or because they perceive them as overly complex, causing them considerable difficulty in using them and thus preventing them from performing their daily tasks as required, ultimately leading to system failure (Lah et al., 2020).

The decision-making process related to digital transformation and organizational sustainability can be improved by using Davis' Technology Acceptance Model (TAM). The TAM model was initially designed to provide a logical framework for assessing user acceptance of a particular information system or specific information technology. Perceived utility (PU) and perceived ease of use (PEU) are the two main components of the TAM model. These criteria

are designed to characterize the ease of use and effectiveness of new procedures or technologies. External factors influence both perceived utility and perceived ease of use, positively impacting users' feelings toward using the target system. Furthermore, these variables influence users' behavior within the target system and process (Dash et al., 2023).

2.5 Previous studies

Sabriya & Kundi (2025) entitled: “**Healthcare Quality Enhancement through Implementation of E-Health Records in Saudi Hospitals: An Investigation into the Prospects and Challenges**”

This study investigates the prospects and challenges associated with enhancing healthcare quality through the implementation of electronic health records (EHRs) in Saudi hospitals. Drawing on a cross-sectional research design, the study applied a structured survey approach using a questionnaire administered to key stakeholders within Saudi healthcare institutions. The analysis indicates that, by addressing barriers such as concerns regarding privacy, the costs of implementation, and the availability of appropriate training, Saudi Arabia can utilize EHR systems to meaningfully improve the overall quality of healthcare delivery. The findings emphasize that EHRs may yield important benefits, including streamlined clinical workflows, reductions in medical errors, and improvements in patient outcomes. At the same time, the study identifies substantial obstacles, notably data privacy risks, interoperability challenges, and healthcare professionals' resistance to organizational change. The article concludes with recommendations directed toward policymakers, healthcare providers, and

technology developers to mitigate these challenges and to maximize the potential contribution of EHRs within the Saudi healthcare system.

Asiri et al. (2024) entitled: **“Impact of electronic health services on patient satisfaction in primary health care centers in Southwestern Saudi Arabia”**

This study evaluates the effect of Electronic Health Services (EHS) on patient satisfaction in primary health care centers (PHCCs) in Abha, located in the southwestern region of Saudi Arabia. Using a questionnaire-based analytical cross-sectional design, data were collected from PHCCs in Abha city. Patient satisfaction regarding EHS was assessed with an adapted questionnaire, and all data were entered, scored, and analyzed using IBM SPSS Statistics version 26. The study included 249 participants, 53% of whom were male and 69.5% of whom were married. The most frequently used electronic application was Sehhaty (88.8%), and it was the preferred option for most applicants (73.5%). A majority of participants reported satisfaction with the care received during their visits (71.5%). Female participants exhibited higher satisfaction levels, whereas individuals with higher educational attainment reported lower satisfaction with EHS. Overall, the findings indicate that implementing EHS in PHCCs in southwestern Saudi Arabia is associated with increased patient satisfaction. Accordingly, healthcare providers are encouraged to promote the use of EHS to enhance patient satisfaction and reduce challenges associated with in-person visits. Further research is recommended to assess the impact of EHS across other levels of healthcare throughout the kingdom and among specific population groups.

Alharbi & Kundi (2024) entitled: **“Challenges and opportunities in integrating E-health solutions for enhanced healthcare quality in Saudi hospitals”**

This study examined the effectiveness and efficiency of e-health solutions in Saudi hospitals in relation to improving the resolution of interoperability issues and strengthening data security practices, as well as assessing related patient trust and its implications for the integration of e-health solutions to enhance healthcare quality. To establish the basis of the work, the study reviewed existing literature indexed in Web of Science, Scopus, Embase, PubMed, and ScienceDirect. Empirical data were collected through a structured questionnaire administered by the researchers in healthcare institutions located in the Qassim region, with a sample size of 197 determined according to Krejcie and Morgan’s criteria. The analysis indicated statistically significant positive associations among the study variables, thereby supporting the proposed hypotheses. In addition, the study found that integrated e-health solutions had a significant effect on healthcare quality in Saudi hospitals; specifically, SHQ accounted for 31.7% of the variance in the enhancement of IHS, and the goodness-of-fit statistic was $F = 387.312$. The findings, however, are limited by the study’s geographic scope to the Qassim region and the relatively modest sample size, which restricts the generalizability of the results. Future research should therefore replicate the study using larger samples across multiple regions to further refine the evidence base and strengthen theoretical and practical understanding.

Rifial et al. (2024) entitled: **“Impact of health system usage, patient satisfaction, information quality, and service quality on hospital management information system utilization at Madani Regional General Hospital”**

The study emphasizes the importance of both human and technology-related determinants in the effective use of Hospital Management Information Systems (HMIS), which integrate clinical and administrative workflows and thereby improve operational efficiency, particularly in addressing persistent implementation challenges. However, the realization of HMIS benefits is contingent on multiple factors, including the degree of system use, user satisfaction, the quality of information produced, and the quality of services associated with the system. To examine these relationships, the study applied a quantitative cross-sectional design at Madani Regional General Hospital in Palu, Indonesia, focusing on the association between human and technological factors and the net benefits attributable to HMIS. A total of 172 respondents, selected using the Slovin formula, completed structured questionnaires assessing system usage, user satisfaction, information quality, service quality, and perceived net benefits. The results showed statistically significant positive associations between system usage, user satisfaction, information quality, and service quality with net benefits. In particular, greater system usage, higher user satisfaction, improved information quality, and better service quality were each strongly linked to more favorable HMIS utilization outcomes. Binary logistic regression further indicated that system usage was the strongest predictor of net benefits. The regression model accounted for 21.2% of the variance in net benefits and yielded a classification accuracy of 79.7%. Overall, strengthening system usage, user satisfaction, information quality,

and service quality is likely to enhance HMIS-derived benefits in hospital contexts, and achieving this may require targeted actions such as user training, system improvements, and the provision of more responsive technical support to optimize HMIS performance and support healthcare delivery.

Woldemariam & Jimma (2023) entitled: “**Adoption of electronic health record systems to enhance the quality of healthcare in low-income countries: a systematic review**”

This study conducted a systematic review of published articles addressing the current status, opportunities, and challenges associated with adopting electronic health record (EHR) systems as a strategy for improving healthcare quality in low-income countries (LICs). Article identification followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, incorporating searches of PubMed, ScienceDirect, and IEEE Xplore, as well as citation tracking and manual search procedures. Eligibility was limited to peer-reviewed studies published between January 2017 and 30 September 2022 that specifically examined the adoption status, challenges, or opportunities of EHR systems in LICs. A total of 12 studies met the inclusion criteria for review. The findings indicate that EHR implementation in multiple LICs is limited and often remains at the pilot stage. Key barriers to EHR adoption include inadequate infrastructure, insufficient management commitment, weak adherence to standards, interoperability limitations, inadequate technical and organizational support, limited user experience, and deficiencies in EHR systems themselves. In contrast, facilitators reported for EHR adoption include healthcare providers’ perceptions and willingness to use electronic

medical records (EMRs), as well as the early-stage development of health information exchange infrastructure.

Reegu et al. (2023) entitled: “**Blockchain-based framework for interoperable electronic health records for an improved healthcare system**”

This research aims to develop an interoperable, blockchain-based electronic health record (EHR) framework capable of meeting requirements specified in multiple national and international EHR standards, including HIPAA and HL7. The study uses a systematic literature review to characterize the current state of the art in EHRs, with particular emphasis on blockchain-enabled EHR implementations. The review identifies interoperability gaps present in existing blockchain-based EHR frameworks, surveys relevant national and international EHR standards, and derives interoperability requirements by mapping them to these standards. The proposed framework is intended to support safer exchange of health information within the healthcare sector while providing key properties for stored records—namely immutability, security, and user control—without reliance on centralized storage. The principal contributions are improved conceptual understanding of blockchain’s applicability to EHR systems and the presentation of an interoperable blockchain-based EHR framework aligned with diverse EHR standards. Overall, the study has substantive implications for healthcare by enabling more secure sharing and storage of electronic health data while maintaining confidentiality, privacy, and the integrity of medical records.

Al-Kahtani et al. (2022) entitled: “**Digital health transformation in Saudi Arabia: A cross-sectional analysis using Healthcare Information and Management Systems Society’digital health indicators**”

This study aims to measure the readiness for digital health transformation at different hospitals in the Eastern Province, Saudi Arabia in relation to Saudi Vision 2030 based on the four dimensions adopted by the Healthcare Information and Management Systems Society: person-enabled health, predictive analytics, governance and workforce, and interoperability. The study was conducted with a cross-sectional design using data collected through an online questionnaire from 10 healthcare settings, the questionnaire consists of the four digital health indicators. The survey was developed by Healthcare Information and Management Systems Society for the purpose of assessing the level of digital maturity in healthcare settings. Ten healthcare facilities in the Eastern Province, both private and governmental, were included in the study. The highest total scores for digital health transformation were reported in private healthcare facilities. The ‘governance and workforce’ was the most implemented dimension among the healthcare facilities in the study, while the dimension that was least frequently implemented was predictive analytics. In addition, tertiary hospitals scored the least in digital transformation readiness compared to primary and secondary healthcare facilities in the study. The results of the study show that private healthcare facilities scored higher in digital health transformation indicators. These results will be useful for promoting policymakers’ understanding of the level of digital health transformation in the Eastern Province and for the creation of a strategic action plan.

Mehmood et al. (2021) entitled: **“Perception of data quality and electronic health information system acceptance, reliability and satisfaction: A study at tertiary care hospital in Saudi Arabia: Electronic health information system: Data quality and user satisfaction”**

Electronic health information systems (EHIS) serve as a foundational component for healthcare planning and the delivery of quality care. This study aimed to examine end-user acceptance, reliability perceptions, and satisfaction with a hospital-based electronic health information system, with particular attention to the experience of users who participate directly in data entry. In addition, the study assessed users’ perceptions of data quality. A questionnaire-based cross-sectional survey was conducted to collect quantitative data from multiple EHIS user groups. The questionnaire consisted of six sections: demographic characteristics of respondents, general assessment of the HIS, availability and accessibility of computer terminals within the hospital, the EHIS’s role in patient care, user satisfaction with the system, and perceptions of data quality. Although desktop computers were available throughout the hospital, the facility lacked handheld devices and computers on wheels. Participants reported satisfaction with the data entry and retrieval processes but indicated insufficient job training related to troubleshooting. Furthermore, users were not adequately informed about system downtime, and related procedures were not clearly communicated. Concerning data quality, most respondents perceived the data to be of adequate quality. The study concludes that improved technical support and enhanced hospital network speed are necessary to ensure more responsive system performance. It also recommends the provision of laptops and handheld computers to support timely data entry during critical situations and ward visits, which may improve data quality and reduce the risk of data loss.

Mohammadpour et al. (2021) entitled: **“Use of hospital information system to improve the quality of health care from clinical staff perspective”**

The present cross-sectional study assessed the views of clinical personnel in hospitals affiliated with Neyshabur University of Medical Sciences regarding the effectiveness of health information systems (HIS) in enhancing staff performance, as well as strategies to improve system effectiveness. A total of 120 clinical staff members who actively used the HIS were included. Data were collected using a two-part questionnaire. Based on participants' responses, HIS effectiveness for improving performance was rated at 64.42%, whereas a developed HIS incorporating the proposed strategies was rated at 81.85%. Using the study's effectiveness scale, the system's performance was estimated to improve from “good” to “excellent” following implementation of the strategies, with a statistically significant difference between pre- and post-effectiveness ($P < 0.001$). Overall, the positive perspective of clinical staff on HIS effectiveness suggests that the hospital environment is conducive to the development and implementation of information technology. The findings further indicate that clinical staff opinions and service needs—given their central role in patient care—should be incorporated to increase the effectiveness of HIS.

Lwoga et al. (2021) entitled: **“Predictors of electronic health management information system for improving the quality of care for women and people with disabilities”**

This study evaluated the use of a Health Management Information System (HMIS) and identified factors associated with its usage and users' behavioral intentions to use the electronic

HMIS (eHMIS) at the Comprehensive Community Based Rehabilitation in Tanzania (CCBRT). Clinical and non-clinical staff (n=69) were surveyed using tablets and online questionnaires, achieving a 71.9% response rate; interviews with ICT staff were conducted to corroborate and extend the survey findings. The survey instrument was structured in line with the updated Information System Success (ISS) model. The results indicated that most health workers (81.2%) used the eHMIS several times per day to support diverse decision-making activities, and that better-educated personnel were more likely to enter data effectively than their counterparts. Of six predictors, self-efficacy showed a positive influence on self-reported HMIS use and on user satisfaction, whereas service quality had a negative effect on self-reported eHMIS use. System quality was positively associated with health workers' satisfaction with the eHMIS, and user satisfaction, in turn, positively predicted continued usage intention. Continued usage intention and user satisfaction were both positively related to the eHMIS's individual impact, and this individual impact was positively associated with the eHMIS's organizational impact.

Gatiti et al. (2021) entitled: **“Enhancing Healthcare Quality in Hospitals through Electronic Health Records: A Systematic Review”**

This review was conducted to assess the extent to which electronic health record (EHR) implementation influences healthcare quality in hospitals and to determine lessons that may inform EHR implementation practice within hospital settings. To achieve this aim, relevant publications were identified through searches of Scopus, PubMed, CINAHL, PsycInfo, and the Cochrane Library, and relevant policy and guideline documents were also examined using

sources such as the World Health Organization and the National Institute for Health and Care Excellence. A search strategy was developed using multiple terms and their variants related to electronic health records, hospitals, and healthcare quality. Only English-language studies published between 2010 and 2020 were included. Results from the included studies were synthesized using a narrative synthesis approach. Overall, the review found that EHR implementation is associated with a meaningful positive effect on healthcare quality, with improvements reported in areas such as patient safety and the delivery of care that is effective, efficient, timely, equitable, and patient-centred. The review further identified EHR capabilities that support quality improvement, including features for practice management; support for communication and documentation/data entry; medication management functions; clinical decision support; computerized medication prescribing; electronic nursing documentation; and electronic management and record systems. Finally, the review characterized implementation barriers as arising from institutional factors, human-resource factors, technological factors, and ethical issues.

Salameh et al. (2019) entitled: **“Nurses' attitudes toward the use of an electronic health information system in a developing country”**

The purpose of this study was to understand and evaluate nurses' acceptance and attitudes about implementation of an electronic health information system in Palestinian hospitals. A descriptive, cross-sectional study was conducted with 191 nurses in three governmental hospitals in Palestine. A majority of these nurses understood the need for and accepted the computer-based documentation as demonstrated by their scores on the attitude

questionnaire. Inclusion of nurses in early phases of planning and implementation is important. Other developing countries can learn from the Palestinian experience with implementation of electronic health records.

Chapter Three

Research Methodology

3.1 Introduction

The methodology used in this study, “The Impact of Electronic Health Information Systems on Improving the Quality of Health Services in Government Hospitals in the Kingdom of Saudi Arabia”, is presented in this chapter. It offers a detailed explanation of the research procedures and approaches that were taken during the study.

The chapter describes the research design, type of the study and the methodological approach used to explore the linkage between **EHIS** and quality of healthcare. Moreover, it is an explanation of the research strategy, target population, sampling technique and sample size determination.

Besides, this chapter talks about the process of creating the research instrument such as the design of a questionnaire, the sources used to develop measurement items, and how the instrument was made valid and reliable. Lastly, data-collection methods and statistical methods for analyzing collected data and testing the hypotheses of the study are presented.

3.2 Research Type and Nature

The study is an applied study in nature because it deals with the solution of an applied problem associated with the implementation of EHIS and the role of EHIS in enhancing the quality of health services in government hospitals in the Kingdom of Saudi Arabia. Applied research not only focuses on developing theoretical knowledge, but also on generating practical

knowledge that can help decision makers and health organizations better perform their roles in providing services.

As for the purpose of the study, it is an explanatory research study. Explanatory studies are designed to examine and attempt to explain the cause-and-effect relationships between the variables in the research. The article aims to describe the effect of the independent variable (e-health information system) on the dependent variable (quality of health services) in this context. The five dimensions of the SERVQUAL model – namely tangibles, reliability, responsiveness, assurance and empathy – are used to assess the quality of health services.

In terms of the presence or absence of the researcher's control over the study variables, this research belongs to a non-experimental research. In terms of the control or manipulation of the independent variable by the researcher, this research is a non-experimental research because the researcher does not control or manipulate the independent variable. Rather, data are gathered in the natural work setting from health care professionals to explore health care professionals' perspectives on the role and impact of EHIS.

In addition, this study uses a cross sectional research design because the data obtained from the respondents is gathered at one time within a period. This design can be used to explore the status of the implementation of EHS and the association between the implementation of EHS and the quality of healthcare services provided by healthcare workers in governmental hospitals.

3.3 Research Method

The research method used in the study is descriptive analytical method as appropriate method to achieve the research objectives. The descriptive approach helps the researcher to describe the current status of EHIS implementation and to identify the perception of healthcare professionals on the quality of healthcare services that are offered in government hospitals.

This type of approach enables the researcher to understand the relationships between the study variables and to see how much electronic health information systems can help in improving various dimensions of healthcare service quality.

The data used in the study is quantitative data which is obtained by using a structured questionnaire made specifically for this research. The purpose of the questionnaire is to assess the perceptions of healthcare professionals on the availability, effectiveness, use and impact of electronic health information systems.

The data collected are statistically analyzed to describe the characteristics of the respondents, to assess their perception on study variables and to test the proposed hypotheses on how electronic health information system affects the quality of healthcare services.

3.4 Research Strategy

A survey research strategy is one of the most used strategies in quantitative research that can be used to collect data from a relatively large number of respondents and this is the strategy used in the current study. This is a suitable strategy as the study is trying to examine the perception of healthcare professionals, and the relationship between the electronic health information systems and healthcare service quality.

Structured questionnaire was the main data collection tool used. The questionnaire was sent to healthcare professionals who are involved in the provision of care in government hospitals in the Kingdom of Saudi Arabia, such as drug administrators, administrative healthcare workers, physicians, nurses, healthcare technicians, and anyone else who is involved in the provision of healthcare and is faced with using electronic health information systems as a part of their daily work in government hospitals.

The survey method enables the researcher to gather standardized data from respondents, which makes statistical comparisons with the data possible and may enable the hypotheses to be tested. The collected data were processed using both descriptive and inferential statistical techniques to see how strong the relationship is between electronic health information systems and healthcare service quality and what kind of relationship it is.

This approach helps to produce credible evidence to inform healthcare administrators and policymakers of the impact of digital transformation on service delivery in healthcare.

3.5 Research Population and Sample

3.5.1 Research Population

The research population is the total number of people who have shared characteristics of interest to the study's purpose from which the researcher plans to gather data. The study population includes all the healthcare professionals who use and/or interact with Electronic Health Information Systems (EHIS) in their work activities at government hospitals in the Eastern Province in the Kingdom of Saudi Arabia.

The study population consists of different categories of healthcare workers such as physicians, nurses, pharmacists, healthcare technicians and administrative healthcare staff of government hospitals, affiliated with the Ministry of Health and other governmental healthcare organizations in the Eastern Province.

The Eastern Province is one of the most significant healthcare areas in Saudi Arabia, home to a significant number of government hospitals and healthcare facilities which have undergone an ongoing process of digital transformation in accordance with Saudi Vision 2030's goals. This transformation centers on the goal of making healthcare more efficient, better, and more integrated and used with digital health technologies.

The government hospitals in the Eastern Province have adopted several electronic health systems such as Electronic Medical Records (EMR), Hospital Information Systems (HIS), Clinical Information Systems (CIS), and other digital health solutions. These systems have revolutionized how healthcare information is captured, stored, shared, and used for clinical decisions and services.

Healthcare practitioners are the most likely group to be the end users of EHIS systems, and have first-hand experience in the effectiveness, usability, and how these systems can improve the quality of health services, including reliability, responsiveness, assurance, empathy, and tangible aspects of service delivery.

As per available health care workforce statistics, the Eastern Province has significant health care workforce present in governmental health care facilities. The present study, however, targets specifically the healthcare professionals of government hospitals with first-hand experience of the use of EHIS in the Eastern Province. Thus, the study population is

assumed to be approximately: 30,000 health care professionals who use EHS in their work in government hospitals in the Eastern Province.

3.5.2 Research Sample

A sample is a group of units taken from the research population using scientific methods to represent the characteristics of the population as a whole, and to generalize the findings of the research (Sekaran & Bougie, 2016). It is difficult to collect data from the entire population, as the Eastern Province has a large number of healthcare professionals, and are spread geographically amongst government hospitals. Hence, a suitable sample was chosen to meet the goals of the study and ensure statistical accuracy and reliability. The study employed simple random sampling technique in which each member of the target population had equal chance of being selected. In this sampling method, the selection of the sample is less biased and the sample is more representative. The sample size was determined using the Krejcie and Morgan (1970) sample size table. the sample size they are looking for is about: 377 respondents

The sample size used is adequate for this type of analysis, when dealing with the relationship between Electronic Health Information Systems and Quality of Health Services at 95% confidence level and $\pm 5\%$ margin of error. The questionnaire was therefore sent via email to healthcare professionals from government hospitals in the Eastern Province of Saudi Arabia. Overall, 385 valid responses were obtained and analyzed statistically. This number of samples was considered to be more than the required number of samples and was adequate for the purpose of the study, as well as to examine the effects of Electronic Health Information Systems on the quality of healthcare services. The research instrument used was a questionnaire. The

research instruments adopted were questionnaire. The sources of secondary and primary sources were mainly used for gathering the needed data and information in the current study.

3.6 Research Instrument and Data Collection Methods

The current study relied on two main sources for collecting the required data and information: secondary sources and primary sources.

First: Secondary Sources

To gather accurate and relevant information that will contribute to the objectives of the study, the researcher used a wide array of secondary sources such as scientific books, peer-reviewed journal articles, previous studies, academic theses, healthcare-related reports, and reliable electronic databases that are pertinent to the topic of electronic health information systems and the quality of healthcare services. They were involved in the theoretical framework of the study, the main research variables and their dimensions were identified, and the questionnaire items were developed. In addition, a review of previous empirical research on electronic health information systems, digital healthcare transformation and service quality models was conducted to guarantee that the measurement items were an accurate representation of the concepts being studied. The secondary sources were also useful for the researcher in determining the appropriate dimensions to measure the independent variable, Electronic Health Information Systems (EHIS), and the dependent variable, Quality of Health Services, measured by five dimensions which are tangibles, reliability, responsiveness, assurance and empathy.

Second: Primary Sources

Structured questionnaire was used to gather primary data for this study, which was specially designed to meet the goals of the study. The designed questionnaire aimed to assess the perception of the healthcare professionals about the implementation and effectiveness of electronic health information systems, and their impact on enhancing the quality of healthcare services in government hospitals in the Kingdom of Saudi Arabia. The items in the questionnaire were formulated on the basis of literature review related to the theoretical background and previous empirical research on electronic health information systems and quality of healthcare services. The instrument was designed to represent all the research variables and dimensions equally well. The questionnaire was sent to health care professionals in government hospitals in Saudi Arabia via Google Forms. An introduction to the questionnaire was included that outlined the objectives of the study, ensured anonymity for the participants and explained that the information gathered would be for academic research purposes only. Participants were asked to respond to all statements objectively and accurately with reference to their personal experience with the EHS in their workplaces.

3.6.1 Questionnaire Design

The researcher designed the questionnaire as the main instrument to collect the data. The questionnaire designed by keeping the goals of the study and the conceptual framework in mind, taking into account the nature of the health care environment and the characteristics of the respondents targeted.

The questionnaire consisted of three main sections as follows:

Section One: Demographic Information

The first part consisted of the demographic features of the respondents to describe the profile of the respondents. This section included: Gender, Age, Educational Level, Years of Experience, Job Position

The demographic variables were added to describe the personal and professional characteristics of the participants and to determine if there are differences in the perception of the participants based on these characteristics.

Section Two: Electronic Health Information Systems (Independent Variable)

The second section measured the independent variable, Electronic Health Information Systems (EHIS).

Seven items were included in this section to assess the respondents' perceptions of the availability, accessibility, effectiveness, information management capabilities and usefulness of electronic health information systems in government hospitals.

Section Three: Quality of Health Services (Dependent Variable)

The third section was for the dependent variable of Quality of Health Services, which was assessed according to the SERVQUAL dimensions. This section contained 25 items in five dimensions as follows:

1. Tangibles

Five indicators were used to measure the role of EHIS in the improvement of technological infrastructure, healthcare facilities, patient records management, and overall healthcare environment in this dimension.

2. Reliability

This dimension consisted of five items that assessed the capabilities of EHIS to improve the accuracy, decrease errors, ensure the correct medical record and ensure uniform healthcare service delivery.

3. Responsiveness

This dimension encompassed 5 related items regarding the impact of EHIS on response time, waiting time, communication and healthcare decisions.

4. Assurance

Five items on the dimensions of EHIS's influence on patient trust, information security, confidentiality, healthcare safety and confidence in hospital services were included.

5. Empathy

There were five items to assess the role of EHIS in supporting patient-centered care, better communication with patients, understanding of patient needs, and better patients' experiences, included in this dimension.

The questionnaire items were presented in a five-point Likert scale of

1=Strongly Disagree,2=Disagree,3=Neutral,4=Agree,5=Strongly Agree

The questionnaire was drafted in English because the target group are healthcare professionals, who are familiar with professional healthcare terminology. The last questionnaire is presented in Appendix (1).

Table (3.1): Questionnaire Structure and Distribution

Variable	Dimensions	Number of Items
Demographic Information	Gender, Age, Educational Level, Years of Experience, Job Position	---
Independent Variable: Electronic Health Information Systems (EHIS)	EHIS implementation, accessibility, health information management, information sharing, and decision support	7
Dependent Variable: Quality of Health Services	Tangibles	5
Quality of Health Services	Reliability	5
Quality of Health Services	Responsiveness	5
Quality of Health Services	Assurance	5
Quality of Health Services	Empathy	5
	Total Questionnaire Items	32

3.6.2 Data Collection Procedure

The researcher used a systematic process of data collection, so as to ensure accuracy of the data obtained as well as the reliability of the data obtained. The questionnaire was created through a theoretical framework and by reviewing previous studies concerning the EHS and health service quality. The questionnaire was first drafted and then reviewed by academics who specialize in healthcare management, information systems and research methodology, to assess the clarity, relevance and appropriateness of the items.

The experts' comments and recommendations were used to make the appropriate changes to enhance the wording of the questionnaire and to ensure that the variables being researched were accurately represented.

Once the questionnaire was completed, it was digitized using Google Forms and sent via the internet to health care professionals in government hospitals in the Kingdom of Saudi Arabia. An introduction to the research purpose, the voluntary nature of participation, confidentiality of responses, and the academic use of the data were explained in the questionnaire. Responses were then reviewed, coded and analyzed using statistical software.

Descriptive and preliminary analysis were performed using the Statistical Package for Social Sciences (SPSS) and the structural model was tested using the SmartPLS 4 software and the hypothesized relationships between electronic health information systems and quality of health services were examined.

3.7 Validity of the Research Instrument

Validity is the degree to which the research instrument is valid in measuring the concepts it is supposed to measure. The questionnaire was validated by construct validity and expert evaluation in this study.

Face Validity

The preliminary questionnaire was shown to a group of academics and specialists of healthcare management, healthcare informatics and research methodology to ensure face validity. The experts were asked to assess the clarity of the statements, relevance of the items to the dimensions of electronic health information systems and healthcare service quality, appropriateness of the language, and the extent to which the questionnaire covers the dimensions of electronic health information systems and healthcare service quality.

Several modifications were taken into account based on the feedback received from the reviewers such as revising some unclear statements, changing the wording and making sure that all items of the questionnaire were relevant and in line with the purpose of the study. The final questionnaire was developed incorporating the suggestions made for improvements and is included in Appendix (1).

3.8 Statistical Analysis Methods Used in the Study

Several statistical tools such as SPSS and SmartPLS 4 were used to analyze the data, test the research hypotheses, and investigate the effect of Electronic Health Information Systems (EHIS) on Quality of Health Services.

First: Statistical Analysis Using SPSS

The following analyses were carried out using SPSS:

1. Descriptive Statistics

Frequencies and percentages were used to describe respondents' demographic characteristics. The mean and standard deviations were used to determine respondents' perception towards the dimensions of EHIS and quality of health services.

2.The reliability test is carried out by Cronbach's alpha. Cronbach's alpha is used in the reliability test.

Used to assess the internal consistency and reliability of the questionnaire items. Performed for EHIS as well as the five dimensions of service quality (Tangibles, Reliability, Responsiveness, Assurance and Empathy).

3. Multicollinearity Test

To avoid high correlations among the study variables, the variance inflation factor (VIF) and tolerance was used.

Second: Statistical Analysis Using SmartPLS 4

SmartPLS 4 was used to apply Partial Least Squares Structural Equation Modeling (PLS-SEM) as follows:

1. Measurement Model Assessment

Item Loadings, Composite Reliability (CR), Average Variance Extracted (AVE), Discriminant Validity (Fornell-Larcker and HTMT criterion).

2. Structural Model Assessment

The two values listed are called Path Coefficients (β).

A method of testing the significance of hypotheses, called a bootstrap technique.

Calculates z and p values to check the significance of relationships.

3. Direct Effects Analysis

Reviewed the influence of EHIS on three aspects of quality of care in health services:

Tangibles, Reliability, Responsiveness, Assurance, Empathy.

4. Model Explanatory Power

Coefficient of Determination (R^2) to assess how well EHIS accounts for the variation in the quality of healthcare services.

Chapter Four

Results

4.1 Introduction

The findings of the study titled “The Impact of Electronic Health Information Systems on Improving the Quality of Health Services in Government Hospitals in the Eastern Province of Saudi Arabia” is presented in this chapter. The analysis is based on information gathered from 385 healthcare professionals in government hospitals.

This chapter discusses the demographic characteristics of the respondents as well as descriptive statistics of the study variables, and the results of the reliability and validity test of the measurement model using PLS-SEM. In addition, the effect of EHIS on dimensions of the quality of healthcare services Tangibles, Reliability, Responsiveness, Assurance and Empathy is examined through hypothesis testing. Lastly, the results from the structural model and the explanation of the model based on R^2 values are shown.

4.2 Demographic Characteristics

Table (4.1). Demographic Characteristics of Respondents (N = 385)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	173	44.9
	Female	212	55.1
Total		385	100
Age	Less than 30 years	92	23.9
	30–39 years	156	40.5
	40–49 years	98	25.5
	50 years and above	39	10.1
Total		385	100

Educational Level	Diploma or less	58	15.1
	Bachelor's degree	247	64.2
	Master's degree	65	16.9
	PhD	15	3.9
Total		385	100
Years of Experience	Less than 5 years	96	24.9
	5–10 years	134	34.8
	11–15 years	86	22.3
	More than 15 years	69	17.9
Total		385	100
Job Position	Physician	72	18.7
	Nurse	184	47.8
	Pharmacist	42	10.9
	Administrative staff	61	15.8
	Other (Healthcare technicians)	26	6.8
Total		385	100

Table (4.1) presents the demographic characteristics of the 385 respondents who participated in the study. Regarding gender, 212 respondents (55.1%) were female, while 173 respondents (44.9%) were male, indicating a slightly higher representation of female healthcare professionals.

In terms of age, the largest group of respondents was 30–39 years, accounting for 156 respondents (40.5%), followed by those aged 40–49 years with 98 respondents (25.5%), respondents aged less than 30 years with 92 respondents (23.9%), and those aged 50 years and above with 39 respondents (10.1%).

With respect to educational level, the majority of participants held a Bachelor's degree (247, 64.2%), followed by a Master's degree (65, 16.9%), Diploma or less (58, 15.1%), while only 15 respondents (3.9%) held a PhD.

Regarding years of experience, the highest proportion of respondents had 5–10 years of experience (134, 34.8%), followed by less than 5 years (96, 24.9%), 11–15 years (86, 22.3%), and more than 15 years (69, 17.9%).

Finally, concerning job position, nurses represented the largest occupational group (184, 47.8%), followed by physicians (72, 18.7%), administrative staff (61, 15.8%), pharmacists (42, 10.9%), and healthcare technicians (26, 6.8%). These findings indicate that the study sample included respondents from various healthcare professions and demographic backgrounds, providing a comprehensive representation of healthcare professionals working in government hospitals in the Eastern Province of Saudi Arabia.

4.3 Descriptive Statistics

The researcher adopted the five-way Likert scale in the questionnaire to give more flexibility to the individuals in the choice, as the value ranged between (1-5) shown in table (4.2).

Table (4.2): Five-point Likert scale to measure agreement

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Source: By Researcher

Likert scale was processed according to the following equation (Sekaran & Bougie, 2016).

$$category\ length = \frac{Maximum\ Substitute - Minimum\ Substitute}{number\ of\ level} = \frac{5-1}{3} = \frac{4}{3} = 1.33$$

Category length + less weight = $1.33+1 = 2.33$, The first degree of agreement (1-2.33) becomes the lower level, to move to the second category $1.33+2.33 = 3.66$, then the second degree of agreement (2.34 – 3.66) becomes the intermediate level, For the transition to the third category $1.33+ 3.66 = 5$ then the third degree of agreement (3.67-5)

becomes the high level. Based on the treatment, the relative approval was determined according to the table (4.3) of the averages of the agreement levels.

Table (4.3): Likert scale processing

The degree of agreement	Average
Low	1-2.33
Medium	2.34-3.67
High	3.68-5

Source: By Researcher

Table (4.4): Descriptive Statistics of Electronic Health Information Systems (EHIS)

no.	items	Mean	Std. Deviation	rank	importance
1	My hospital has an effective electronic health information system.	4.13	0.65	1	High
2	EHIS offer easy access to patients health information.	4.00	0.80	4	High
3	EHI systems enhance health record management and storage.	4.06	0.78	2	High
4	EHIS promote the exchange of information between health care actors.	3.83	0.92	7	High
5	EHIS facilitates healthcare providers' decisions in a clinical context.	3.94	0.81	6	High
6	Enhanced accuracy of patient information with EHIS.	4.01	0.76	3	High
7	EHIS minimize paperwork and paperwork burden.	3.95	0.86	5	High
	EHIS	3.99	0.60		High

The descriptive statistics of the Electronic Health Information Systems (EHIS) construct are displayed in Table (4.4). The overall mean score for EHIS was 3.99 (SD = 0.60), with respondents in general agreeing on the level of implementation and effectiveness of EHIS in the government hospitals. The highest mean score (M = 4.13, SD = 0.65) was observed for "My hospital has an effective electronic health information system", which ranked first, meaning that respondents strongly believed that their hospital had EHIS that was effective. The role of EHIS in improving information management and data accuracy was perceived positively with the results of the two items "EHI systems enhance health record management and storage" (M = 4.06, SD = 0.78) and "Enhanced accuracy of patient information with EHIS" (M = 4.01, SD = 0.76).

The least liked item was "EHIS promote the exchange of information between healthcare actors" (M = 3.83, SD = 0.92). Despite the lowest mean, it was within the high level of agreement which indicates that the respondents seemed to agree that EHIS support communication and sharing of information between health care providers.

Table (4.5): Descriptive Statistics of the Tangibles Dimension of Healthcare Service Quality

no.	items	Mean	Std. Deviation	rank	importance
1	EHIS has the ability to provide modern healthcare technology to the hospital.	4.09	0.72	1	High
2	eHealth records and document systems improve the administration of patient records and documents.	3.95	0.74	3	High
3	Healthcare information systems offer a better technological setting of healthcare services.	3.60	0.99	5	Medium
4	EHI Systems are a part of improved hospital	4.07	0.74	2	High

	resource management.				
5	EHIS enhances the customer experience.	3.90	0.80	4	High
	Tangibles	3.92	0.58		High

Table (4.5) shows the descriptive statistics of the Tangibles dimension of the quality of health care services. The average score of the dimension was 3,92 (SD = 0,58) and showed a high level of agreement among the respondents on the contribution of Electronic Health Information Systems (EHIS) to tangible dimensions of the quality of healthcare services.

The highest rated was "EHIS has the capability to introduce modern healthcare technology to the hospital" (M = 4.09, SD = 0.72) and the second was "EHI Systems are a part of improved hospital resource management" (M = 4.07, SD = 0.74). The results showed that the respondents saw EHIS as being a very important part of modernizing the technology system in healthcare and improving the management of the resources in the hospital.

The lowest rated item was "Healthcare information systems provide a better technological environment of the healthcare services" (M = 3.60, SD = 0.99); the only item rated at a medium level. Even with this, there were still high levels of agreement on some of the other items, such as improvements in patient record administration (M = 3.95) and customer experience (M = 3.90).

Table (4.6): Descriptive Statistics of the Reliability Dimension of Healthcare Service Quality

no .	items	Mean	Std. Deviation	rank	importance
1	The use of electronic health information	4.02	0.78	1	High

	systems enhances the quality of health care services.				
2	EHIS minimizes patient information errors.	3.83	0.86	3	High
3	Electronic health information systems help to maintain reliable medical records.	3.86	0.81	2	High
4	EHIS systems enhance uniformity of health care service.	3.82	0.76	4	High
5	EHIS supports the provision of accurate services to healthcare providers.	3.79	0.77	5	High
	Reliability	3.86	0.62		High

The descriptive statistics of the Healthcare service quality dimension of Reliability are shown in Table (4.6). The respondents generally agreed that Electronic Health Information Systems (EHIS) play an important role in ensuring the reliability of healthcare services with a mean score of 3.86 (SD = 0.62).

The highest mean score ($M = 4.02$, $SD = 0.78$) was obtained for the item: The use of electronic health information systems enhances the quality of health care services, which was ranked first. This shows that the participants strongly considered EHIS to be a major enabler of better quality and reliability of healthcare services. The second most popular item was "Electronic health information systems help to maintain reliable medical records" ($M = 3.86$, $SD = 0.81$) which demonstrates the significance of EHIS for the maintenance of reliable medical records.

“EHIS supports the provision of accurate services to healthcare providers” was the least desirable ($M = 3.79$, $SD = 0.77$). The level of agreement, however, was still high and positive and showed that respondents generally understood the positive role EHIS played in ensuring the accuracy and consistency of services.

Table (4.7): Descriptive Statistics of the Responsiveness Dimension of Healthcare Service Quality

no.	items	Mean	Std. Deviation	rank	importance
1	EHIS minimizes patients wait time.	3.35	1.16	5	
2	EHIS will enhance the timeliness of health services.	3.88	0.82	2	High
3	EHIS allows for rapid response to patients' needs.	3.89	0.88	1	High
4	EHIS enhances communication between health care providers.	3.84	0.81	3	High
5	EHIS helps to make timely healthcare decisions.	3.79	0.83	4	High
	Responsiveness	3.75	0.73		High

The descriptive statistics for the Responsiveness dimension of healthcare service quality are shown in Table (4.7). The overall mean score for this dimension was 3.75 (SD = 0.73), which showed high level of agreement among respondents about the role Electronic Health Information Systems (EHIS) can play in enhancing the responsiveness of healthcare services. The top-rated responses were: EHIS will improve the timeliness of health services (M = 3.88, SD = 0.82) and EHIS allows for rapid response to patients' needs (M = 3.89, SD = 0.88). These findings suggest that respondents see EHIS as an effective tool to facilitate the delivery of services at a faster rate to improve the ability of healthcare providers to react to patient needs.

The item "EHIS enhances communication between health care providers" was rated as third (M = 3.84, SD = 0.81), signaling that electronic systems have a positive impact on

improving communication and coordination between healthcare professionals. The lowest rated item was “EHIS minimizes patients wait time” ($M = 3.35$, $SD = 1.16$) which was not rated as high, indicating that the respondents were less certain about the direct impact of EHIS on the minimization of patients wait time.

Table (4.8): Descriptive Statistics of the Assurance Dimension of Healthcare Service Quality

no.	items	Mean	Std. Deviation	rank	importance
1	Use of electronic health information systems builds patients' trust in health services.	3.87	0.87	3	High
2	EHIS makes patient data more secure.	3.78	0.96	4	High
3	The electronic health information systems guarantee privacy of health information.	3.75	0.91	5	High
4	EHIS improves the practice of healthcare safety.	3.94	0.96	2	High
5	The use of electronic health information systems helps to build trust in health care at hospitals.	4.14	0.79	1	High
	Assurance	3.90	0.73		High

The descriptive statistics for the Assurance dimension of healthcare service quality is given in Table (4.8). The overall mean score for this dimension was 3.90 ($SD = 0.73$), which suggested a high level of agreement among the respondents regarding the contribution of Electronic Health Information Systems (EHIS) to enhancing assurance with regard to healthcare services.

First was "The use of electronic health information systems helps to build trust in health care at hospitals" ($M = 4.14$, $SD = 0.79$), the top-rated item. This suggests that the respondents viewed EHIS as a necessary element that would be important to improve patients' confidence and trust in healthcare services. The second most popular was "EHIS

enhances the practice of healthcare safety" ($M = 3.94$, $SD = 0.96$), which has a positive connotation of how electronic systems support safer healthcare practices.

The rating of the lowest rated item was "The electronic health information systems guarantee privacy of health information" ($M = 3.75$, $SD = 0.91$). It scored the lowest mean, but was still in the high level of agreement range, meaning that respondents generally agreed that EHIS would play a role in protecting patient information and maintaining confidentiality.

Table (4.9): Descriptive Statistics of the Empathy Dimension of Healthcare Service Quality

no.	items	Mean	Std. Deviation	rank	importance
1	Information systems in health care are called Electronic Health Information Systems, which serve the delivery of patient-centered health care services.	4.26	0.70	1	High
2	Electronic health information systems assist health care providers to learn about patients.	4.07	0.84	4	High
3	EHIS systems, or EHS, enhance communication with patients.	4.17	0.75	3	High
4	PHS is enabled by EHI systems.	4.04	0.92	5	High
5	EHI systems have a positive impact on patients' health experiences.	4.19	0.78	2	High
	Empathy	4.15	0.67		High

The results of the descriptive statistics for the Empathy dimension of the quality of healthcare services are shown in Table (4.9). The overall mean score for this dimension was 4.15 ($SD = 0.67$), showing favorable responses from the respondents for the role of EHS systems in improving patient-centered healthcare and interaction with patients.

The highest rated was "Information systems in health care are Electronic Health Information Systems, which provide patient-centered health care service delivery" ($M = 4.26$, $SD = 0.70$), ranking number one. This suggests that respondents' attitude of EHIS for supporting patient-centered care approaches was high. The second most scored item was "EHI systems have a positive impact on patients' health experiences" with a mean score of $M = 4.19$, $SD = 0.78$, indicating that EHIS positively impact on patients' experiences of healthcare.

The item that was rated lowest was "PHS is enabled by EHI systems" ($M = 4.04$, $SD = 0.92$). Despite this, there was a high degree of consensus, suggesting that participants understood the importance of electronic systems for providing personalized healthcare services.

4.4 Normality

Normality assumption is the extent to which data is normally distributed with a bell-shaped distribution. There are several ways to determine if a distribution is normal, including descriptive statistics such as skewness and kurtosis values (Joseph F. Hair Jr. et al., 2017; Julie Pallant, 2016). This study adopted skewness and kurtosis as normality tests, based on previous studies that used this method. The literature suggests that skewness and kurtosis values fall within the range of 2 to -2 are accepted as normal (Garson, 2012; Razali et al., 2012). All values from the above results in Table (4.10) were found to be within acceptable range, which means that the data was normally distributed.

Table (4.10): Values of Skewness and Kurtosis for Construct under Studied

	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
EHIS1	-0.588	0.124	1.108	0.248
EHIS2	-0.968	0.124	1.441	0.248
EHIS3	-0.988	0.124	1.369	0.248
EHIS4	-0.812	0.124	0.533	0.248
EHIS5	-0.759	0.124	0.749	0.248
EHIS6	-0.733	0.124	1.091	0.248
EHIS7	-0.929	0.124	1.143	0.248
EHIS	-0.422	0.124	0.386	0.248
Tangibles1	-1.032	0.124	2.634	0.248
Tangibles2	-0.746	0.124	1.094	0.248
Tangibles3	-0.615	0.124	-0.071	0.248
Tangibles4	-0.721	0.124	0.706	0.248
Tangibles5	-0.761	0.124	0.643	0.248
Tangibles	-0.241	0.124	0.481	0.248
Reliability1	-0.763	0.124	0.965	0.248
Reliability2	-0.703	0.124	0.493	0.248
Reliability3	-0.932	0.124	1.474	0.248
Reliability4	-0.839	0.124	1.47	0.248
Reliability5	-0.644	0.124	0.679	0.248
Reliability	-0.419	0.124	1.054	0.248
Responsiveness1	-0.376	0.124	-0.867	0.248
Responsiveness2	-0.895	0.124	1.192	0.248
Responsiveness3	-0.984	0.124	1.214	0.248
Responsiveness4	-0.757	0.124	0.953	0.248
Responsiveness5	-0.657	0.124	0.459	0.248
Responsiveness	-0.467	0.124	0.729	0.248
Assurance1	-0.943	0.124	1.165	0.248
Assurance2	-0.934	0.124	0.666	0.248
Assurance3	-0.677	0.124	0.267	0.248
Assurance4	-0.751	0.124	0.005	0.248
Assurance5	-1.047	0.124	1.88	0.248
Assurance	-0.834	0.124	1.092	0.248
Empathy1	-0.875	0.124	1.354	0.248
Empathy2	-0.841	0.124	0.726	0.248
Empathy3	-0.73	0.124	0.586	0.248

Empathy4	-0.925	0.124	0.745	0.248
Empathy5	-0.788	0.124	0.471	0.248
Empathy	-0.417	0.124	-0.346	0.248

4.5 Measurement Model Assessment

Partial Least Squares Structural Equation Modeling (PLS-SEM) is one of the popular statistics methods used to examine the relationship between variables and research models. The measurement model is mainly concerned with the strength of the links between the observed indicators and underlying constructs (Salloum & Shaalan, 2018). It seeks to provide an evaluation of the degree of accuracy that the measurement items exhibit when measuring the constructs they are designed to measure. The evaluation of the measurement model was carried out by considering three criteria: indicator reliability, internal consistency reliability, and convergent validity (Mohajan, 2017).

4.5.1 Indicator Reliability

Indicators' reliability relates to the degree of correlation between the indicator and the latent variable they measure (Ramayah et al., 2016). The outer loading values of 0.70 or above are acceptable in PLS-SEM. All indicator loadings were above the recommended level with some at levels near the recommended level as presented in Table (4.11). The outer loadings ranged from 0.710 to 0.894, which demonstrated good relationships among the measurement items and their constructs. The outcome indicate that indicators have acceptable reliability and support for the measurement model is adequate.

4.5.2 Internal Consistency Reliability

Internal consistency reliability is the extent to which the items measuring the same construct yield consistent results. Cronbach's Alpha (CA) and Composite Reliability (CR) are commonly used to evaluate it in the context of PLS-SEM analysis (Ramayah et al., 2016). Values below 0.60 are not acceptable, values above 0.70 are acceptable (Pavlov et al., 2021).

Cronbach's Alpha and Composite Reliability values for the scales presented in Table (4.11) ranged between 0.845 and 0.916, and 0.880 and 0.917 respectively. These values are above the recommended value, suggesting good internal consistency of the measurement items. Hence, the constructs reflect high reliability and the responses gained from the participants are reliable and consistent.

4.5.3 Convergent Validity

Convergent validity is the degree of variance shared at high levels by indicators of the same construct (Fornell & Larcker, 1981). Convergent validity is measured in PLS-SEM with the Average Variance Extracted (AVE) and values greater or equal to 0.50 suggest acceptable validity.

As can be seen in the table (4.11), the convergent validity of all constructs was satisfactory with an AVE value range from 0.632 to 0.750, which is higher than the required value of 0.50. Placing scores on the scales, the AVE values were 0.633 for the EHIS scale, 0.690 for Assurance, 0.676 for Empathy, 0.632 for Reliability, 0.750 for Responsiveness and 0.681 for Tangibles. The results show that the constructs accounted for

over 50% of the variance of their indicators, suggesting that the measurement model was adequate and the structural model analysis should be continued.

Table (4.11): Assessment of Reliability and Convergent Validity of the Measurement Model

Items	Outer Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (Ave)
EHIS		0.902	0.909	0.633
EHIS1	0.71			
EHIS2	0.824			
EHIS3	0.724			
EHIS4	0.844			
EHIS5	0.768			
EHIS6	0.867			
EHIS7	0.818			
Assurance		0.887	0.895	0.69
Assurance1	0.832			
Assurance2	0.865			
Assurance3	0.852			
Assurance4	0.749			
Assurance5	0.849			
Empathy		0.88	0.88	0.676
Empathy1	0.788			
Empathy2	0.796			
Empathy3	0.833			
Empathy4	0.845			
Empathy5	0.846			
Reliability		0.845	0.901	0.632
Reliability1	0.715			
Reliability2	0.843			
Reliability3	0.894			
Reliability4	0.879			
Reliability5	0.839			
Responsiveness		0.916	0.917	0.75
Responsiveness1	0.8			

Responsiveness2	0.884			
Responsiveness3	0.873			
Responsiveness4	0.885			
Responsiveness5	0.884			
Tangibles		0.883	0.889	0.681
Tangibles1	0.835			
Tangibles2	0.887			
Tangibles3	0.854			
Tangibles4	0.773			
Tangibles5	0.772			

4.5.4 Discriminant Validity

The results of the correlations among variables are summarized in Table 13, which is used to test the discriminant validity of the measurement model with the Fornell–Larcker criterion. The Average Variance Extracted (AVE) is computed to make sure that each latent construct explains more variance in its indicators than in other constructs in the model. The assessment involves examining the relationship between constructs to identify whether there is any overlap between the variables (Fornell & Larcker, 1981). The acceptable level is based on the convergent validity of the constructs which is calculated through the AVE value, where AVE value ≥ 0.50 means that the construct explains at least 50% of the variance of its indicators. The factor loadings and cross-loadings are also presented in Table (4.11), which shows that all the indicators load more strongly on their respective constructs compared to the cross-loading. This indicates the measurement adequacy as per the criteria of Ramayah et al., (2016). The Fornell-Larcker criterion is used to evaluate the relationship between the indicators which may overlap each other. The square root of the AVE values is also reported in Table (4.12) and form the main diagonal of this table, with the off-diagonal values showing the correlation between constructs. This

provides further evidence supporting the establishment of discriminant validity in the measurement model.

Table (4.12): Assessment of Discriminant Validity Using the Fornell–Larcker Criterion

	Assurance	EHIS	Empathy	Reliability	Responsiveness	Tangibles
Assurance	0.831					
EHIS	0.645	0.796				
Empathy	0.608	0.630	0.822			
Reliability	0.615	0.721	0.778	0.795		
Responsiveness	0.813	0.707	0.636	0.663	0.866	
Tangibles	0.788	0.737	0.637	0.728	0.758	0.825

4.6 Hypothesis Test

Table (4.13): Structural Model Results for the Effect of EHIS on Quality of Health Services

Hyp	Path	β	mean	Standard deviation	T statistics	P values
H1	EHIS -> The Quality of Health Services	0.780	0.782	0.048	16.081	0.000

The results presented in the structural model results in Table (4.13) are the result of testing the direct effect of Electronic Health Information Systems (EHIS) on Quality of Health Services. Results show that EHIS has positive and statistically significant impact on the quality of healthcare services.

The path coefficient ($\beta = 0.780$) indicates that Electronic Health Information Systems positively influence the quality of health services to a great extent. A better

effectiveness and implementation of EHIS is correlated with better overall quality of health services delivered by government hospitals.

The T-value obtained (16.081) is greater than the recommended value of 1.96 and the P-value (0.000) is less than 0.05, indicating that the relationship is statistically significant. Thus, the proposed hypothesis that “EHIWS has a significant positive impact on Quality of Health Services” is accepted.

Overall, the results indicate that EHIS makes a significant contribution to the improvement of the quality of the healthcare services by improving information access, the accuracy of healthcare information, communication, decision making processes and healthcare delivery efficiency in government hospitals in Eastern Province, KSA.

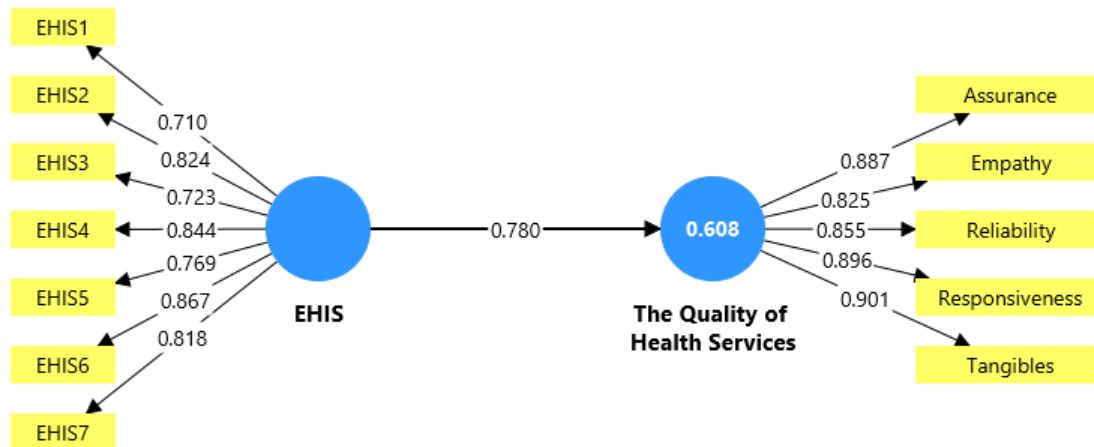


Figure (4.1). Structural Model of EHIS and the Quality of Health Services

Table (4.14): Structural Model Results for the Effects of EHIS on the Dimensions of Healthcare Service Quality

Hyp	Path	β	mean	Standard deviation	T statistics	P values
H1.1	EHIS -> Tangibles	0.73	0.74	0.048	15.401	0.000

		7	1			
H1.2	EHIS -> Reliability	0.72 1	0.72 4	0.054	13.428	0.000
H1.3	EHIS -> Responsiveness	0.70 7	0.71 1	0.053	13.235	0.000
H1.4	EHIS -> Assurance	0.64 5	0.65 1	0.072	8.965	0.000
H1.5	EHIS -> Empathy	0.63 0	0.63 2	0.074	8.557	0.000

Table (4.14) shows the results obtained are: Electronic Health Information Systems (EHIS) are significantly and positively affecting all dimensions of healthcare service quality. The path coefficients (β) are all positive and p-values are all less than 0.05, which indicates the statistical significance of the proposed relationships. The implementation of EHIS had the largest impact on the Tangibles dimension ($\beta = 0.737$, $T = 15.401$, $p < 0.001$), showing that the adoption of EHIS significantly enhances technological infrastructure, healthcare resources and the overall modern healthcare environment. The effect of EHIS on Reliability was also significant ($\beta = 0.721$, $T = 13.428$, $p < 0.001$), indicating that medical records are more accurate, errors are minimized, and healthcare services are provided more consistently thanks to electronic systems. Moreover, EHIS had a significant positive effect on Responsiveness ($\beta = 0.707$, $T = 13.235$, $p < 0.001$), meaning that these systems are associated with the ability of healthcare providers to respond quickly to the needs of patients and to enable timely healthcare decisions. The impact on the variables Assurance ($\beta = 0.645$, $T = 8.965$, $p < 0.001$) and Empathy ($\beta = 0.630$, $T = 8.557$, $p < 0.001$) were also significant, indicating that EHIS also promotes the enhancement of patient trust, information security, communication, and patient-centered healthcare services.

4.7 Coefficient of determination R²

Once the validity of measurement model has been confirmed (Harun et al., 2015), the structural model is then evaluated. The purpose of this stage is to confirm the hypotheses developed and analyse the causal relationships between the constructs of the study model. The analysis of the relationships and the predictive ability of the model was done using Structural Equation Modeling (SEM) with the software SmartPLS 4 (Joseph F. Hair Jr et al., 2016). The ability of the model to predict was evaluated by the coefficient of determination (R²), which shows the percentage that the independent variables account for the variance in the dependent variable. The results validated the appropriateness and effectiveness of the SEM methodology in analyzing the hypothesized relationships in the study framework.

Table (4.15): R² of the endogenous latent variables.

	R-square	R-square adjusted
Assurance	0.416	0.410
Empathy	0.396	0.390
Reliability	0.520	0.515
Responsiveness	0.500	0.495
Tangibles	0.543	0.539

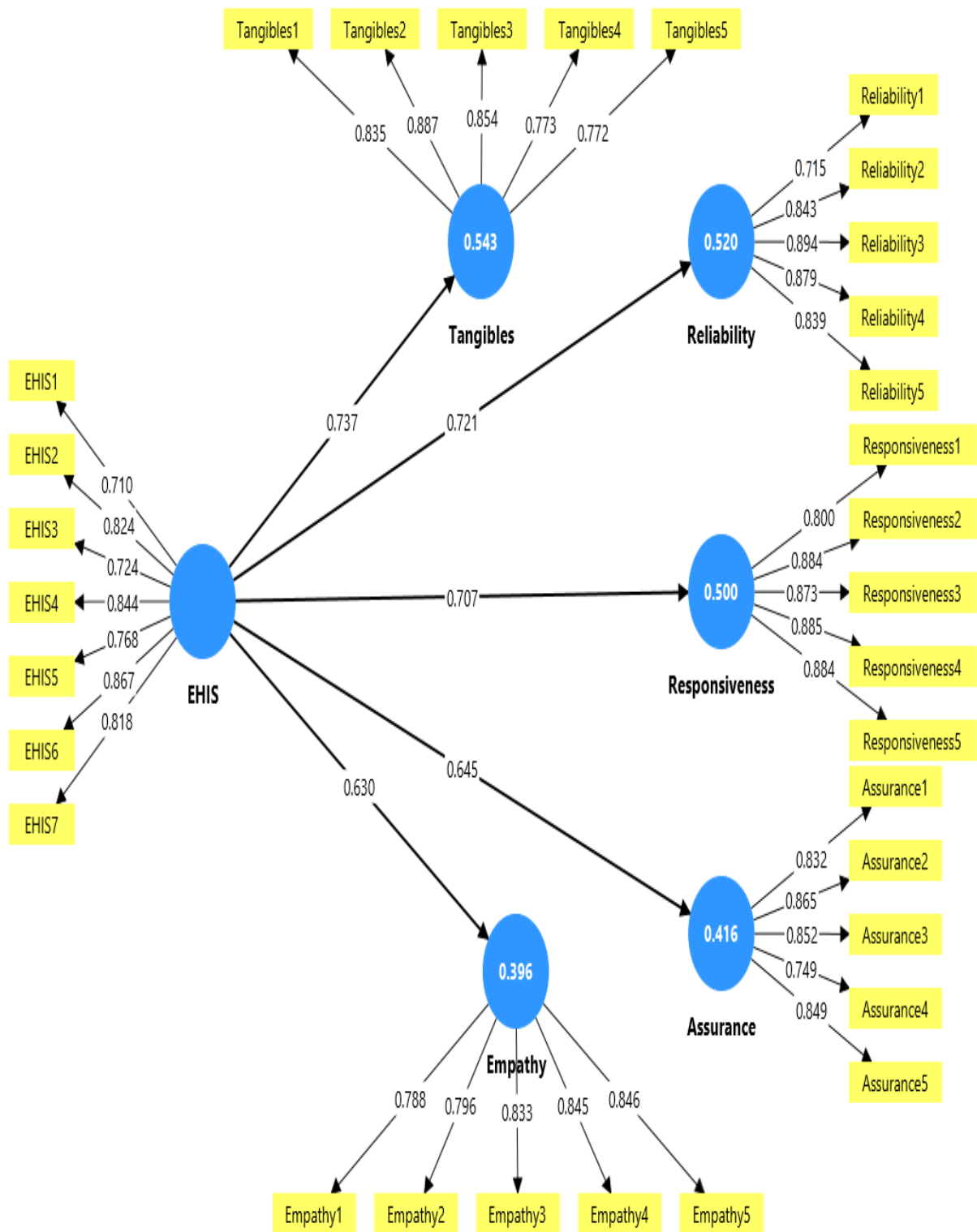


Figure (4.2) : Structural model (path coefficient)

Chapter Five

Discussion and Recommendations

5.1 Introduction

This chapter represents the conclusion of the study. Building upon the analysis presented in the previous chapter, this chapter reviews and discusses the findings and their relationship to the results of previous studies. Based on these findings, the chapter concludes with a set of recommendations.

5.2 Results discussion

The study results demonstrated the validity of the standard model used to measure the study variables. Discriminatory validity tests confirmed that all variables possessed clear conceptual distinctions, and that the indicators for each variable were more strongly correlated with it than with the other variables. Regarding the structural model, the results revealed a statistically significant positive impact of electronic health information systems (EHS) on the overall quality of healthcare services. This confirms that expanding the application of these systems directly contributes to raising the quality of services provided within government hospitals. This finding can be explained by the fact that EHS provides a more efficient work environment through the organization of health data, faster access to information, and improved information exchange among healthcare providers. Furthermore,

it supports more accurate medical and administrative decision-making, which ultimately reflects on the level of service provided to patients.

The results also showed that the impact of EHS extended to all dimensions of healthcare service quality, although the strength of this impact varied from one dimension to another. The Tangibles dimension recorded the highest level of impact, indicating that the implementation of electronic health information systems (EHIs) clearly contributes to developing the technological infrastructure, modernizing the healthcare work environment, and promoting the use of modern technologies and equipment. This, in turn, increases the efficiency of healthcare institutions and reflects a more advanced image of the services provided.

The Reliability dimension came in second in terms of impact strength, demonstrating that the use of EHIs enhances the accuracy of medical records, reduces errors resulting from paper-based transactions, and contributes to the provision of healthcare services in a more consistent and continuous manner. This reflects the important role of these systems in improving the reliability of healthcare services and ensuring that medical procedures are carried out according to more precise standards.

The results also showed a significant positive impact on the Responsiveness dimension, indicating that the use of electronic systems helps healthcare providers respond more quickly to patients' needs by facilitating access to medical information, expediting service delivery procedures, and improving coordination between different departments. This leads to reduced waiting times and increased efficiency in providing timely healthcare. Regarding the dimensions of Assurance and Empathy, the results demonstrated

a statistically significant positive impact, albeit to a lesser extent compared to other operational dimensions. This can be explained by the fact that electronic health information systems contribute to enhancing patient trust in healthcare services by improving information accuracy, maintaining data confidentiality, and supporting effective communication between patients and healthcare providers. These systems also help provide comprehensive patient information, enabling healthcare professionals to better understand patients' needs and provide more human-centered and individualized care.

Overall, the study's findings confirm that investing in electronic health information systems is a strategic choice for enhancing the quality of healthcare services. The impact of these systems extends beyond improving technical and administrative aspects; it also includes improving service delivery efficiency, increasing reliability, accelerating response to patient needs, and strengthening patient trust in healthcare institutions. This supports the government hospitals' move towards digital transformation and achieving higher levels of quality and sustainability in healthcare.

Building on the overall evidence reported in the preceding studies, the present findings can be further elaborated through comparison with the reported relationships between electronic health information systems (EHIS) and service-quality outcomes. Across the literature previously summarized, EHIS implementation is repeatedly linked to quality-related improvements such as enhanced information availability, improved coordination, and reductions in errors. Consistent with these mechanisms, the present study extends prior work by demonstrating that EHIS is not only associated with generalized quality gains, but also shows statistically significant effects across all five service-quality

dimensions measured in government hospitals in the Kingdom of Saudi Arabia—tangibles, reliability, responsiveness, assurance, and empathy. This pattern suggests that system effects are reflected in both operational indicators (e.g., reliability and responsiveness) and patient-experienced aspects (e.g., assurance and empathy), thereby providing a more comprehensive depiction of quality improvement than studies that focus on fewer domains.

In addition, prior studies examining technology acceptance and user experience have suggested that stronger perceptions of usefulness, ease of use, and system/service quality are typically associated with more favorable user behavior and better utilization outcomes (Sabriya & Kundi (2025); Rifial et al. (2024)). The present study's results align with this interpretation by indicating that EHIS implementation in the Eastern Province contributes meaningfully to service quality as experienced in routine hospital care. For example, the observed significance across reliability and responsiveness is consistent with evidence that EHIS can streamline workflows and improve timeliness, thereby supporting more dependable and timely service delivery. Similarly, statistically significant effects in assurance and empathy can be interpreted as downstream consequences of more accurate and accessible patient information, improved continuity of care, and more consistent communication practices enabled by electronic documentation and information retrieval.

A further point of comparison concerns implementation challenges reported in earlier research, including concerns related to data privacy, interoperability, infrastructure limitations, and training needs (Sabriya & Kundi (2025); Rifial et al. (2024); Mehmood et al. (2021)). While those studies highlight that insufficient infrastructure, inadequate user training, or system downtime can constrain the benefits of EHIS, the current findings

indicate that, within the studied government hospitals, the effective use of EHIS is associated with measurable improvements across all major quality dimensions. This does not negate the implementation challenges documented in the literature; rather, it suggests that in the settings examined in the Eastern Province, the practical functioning of EHIS—together with organizational conditions that supported its use—was sufficient to produce broad quality effects. Consequently, the present results can be viewed as evidence that EHIS can translate into multidimensional quality gains even in public hospital environments, provided that the system is operationalized in a manner that supports reliable service delivery.

Finally, compared with studies that report positive associations between EHIS and single or limited quality outcomes (Alharbi & Kundi (2024); Rifial et al. (2024); Woldemariam & Jimma (2023); Mehmood et al. (2021); Mohammadpour et al. (2021); Lwoga et al. (2021); Gatiti et al. (2021)), the present study provides a more detailed and domain-specific contribution by establishing statistically significant impacts across tangibles, reliability, responsiveness, assurance, and empathy. This comprehensive distribution of significant effects strengthens the argument that EHIS influences quality through multiple pathways—technical performance, workflow support, and patient-facing service experiences. Taken together, the comparison with prior literature supports the conclusion that EHIS use in government hospitals in Saudi Arabia can be associated with improvements in patient-perceived and service-experienced quality across key dimensions, thereby reinforcing and extending the evidence base previously reported.

5.3 Recommendations

Based on the above, and relying on the analysis and results obtained, the study recommends the following:

- Strengthen technology quality to improve service reliability and timeliness by implement continuous monitoring of system uptime, response time, and downtime frequency, and incorporate these metrics into hospital performance dashboards.
- Ensure rigorous maintenance schedules, version control, and change-management procedures to minimize disruptions that may affect clinical workflow reliability.
- Improve user-centered system design and usability
- Conduct structured usability assessments with clinicians and administrative staff to identify workflow bottlenecks and interface issues that may reduce effective system use.
- Prioritize system enhancements that improve ease of data entry, retrieval speed, and task completion during routine care processes.
- Develop comprehensive and role-specific training programs, by implement continuous training curricula (not one-time orientation) tailored to user roles (e.g., physicians, nurses, pharmacists, clerks, managers).
- Include practical instruction on troubleshooting, navigation during high-volume periods, and procedures during system downtime.
- Enhance data quality management processes by introduce standardized data entry protocols and clinical documentation guidelines to reduce variability and improve completeness, accuracy, and consistency.

- Expand technical support capacity, responsiveness and strengthen on-site and help-desk support with defined service-level agreements for response and resolution times.
- Support change management and reduce resistance to adoption, including stakeholder engagement, communication plans, and visible leadership support.
- Align EHIS functionality with patient experience objectives by ensuring reliable documentation, timely service delivery, and improved communication processes that support assurance and empathy dimensions.
- Develop processes that ensure patients' service experiences benefit from accurate and timely information available to staff.
- Encourage longitudinal and multi-site research in future doctoral work to establish causality and determine sustainability of quality improvements over time.

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Appendix (1)

Questionnaire

The Impact of Electronic Health Information Systems on Improving the Quality of Health Services in Government Hospitals in the Kingdom of Saudi Arabia

Dear Participant,

You are kindly invited to participate in this research study entitled “**The Impact of Electronic Health Information Systems on Improving the Quality of Health Services in Government Hospitals in the Kingdom of Saudi Arabia.**” This questionnaire aims to investigate the impact of electronic health information systems on the quality of healthcare services in government hospitals.

The participation is much appreciated and will help to understand the impact of EHIS on the quality of healthcare services. All information will be treated confidentially and will only be used for academic research. Read each statement and fill in the column which matches your view.

Response Scale:

Scale	Response
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Thank you for your valuable participation.

Section One: Demographic Information

Please select (✓) the appropriate answer.

Table 1. Demographic Characteristics

No.	Item	Categories
1	Gender	☐ Male ☐ Female
2	Age	☐ Less than 30 years ☐ 30–39 years ☐ 40–49 years ☐ 50 years and above
3	Educational Level	☐ Diploma or less ☐ Bachelor's degree ☐ Master's degree ☐ PhD
4	Years of Experience	☐ Less than 5 years ☐ 5–10 years ☐ 11–15 years ☐ More than 15 years
5	Job Position	☐ Physician ☐ Nurse ☐ Pharmacist ☐ Administrative staff ☐ Other

Section Two: Electronic Health Information Systems (Independent Variable)

Table 2. Electronic Health Information Systems

No.	Statement	1	2	3	4	5
EHIS 1	My hospital has an effective electronic health information system.	☐	☐	☐	☐	☐
EHIS 2	EHIS offer easy access to patients health information.	☐	☐	☐	☐	☐
EHIS 3	EHI systems enhance health record management and storage.	☐	☐	☐	☐	☐
EHIS 4	EHIS promote the exchange of information between health care actors.	☐	☐	☐	☐	☐
EHIS 5	EHIS facilitates healthcare providers' decisions in a clinical context.	☐	☐	☐	☐	☐
EHIS 6	Enhanced accuracy of patient information with EHIS.	☐	☐	☐	☐	☐

EHIS 7	EHIS minimize paperwork and paperwork burden.	☐	☐	☐	☐	☐
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Section Three: Quality of Health Services (Dependent Variable)

A. Tangibles

Table 3. Tangibles Dimension

No.	Statement	1	2	3	4	5
TAN1	EHIS has the ability to provide modern healthcare technology to the hospital.	☐	☐	☐	☐	☐
TAN2	eHealth records and document systems improve the administration of patient records and documents.	☐	☐	☐	☐	☐
TAN3	Healthcare information systems offer a better technological setting of healthcare services.	☐	☐	☐	☐	☐
TAN4	EHI Systems are a part of improved hospital resource management.	☐	☐	☐	☐	☐
TAN5	EHIS enhances the customer experience.	☐	☐	☐	☐	☐

B. Reliability

Table 4. Reliability Dimension

No.	Statement	1	2	3	4	5
REL1	The use of electronic health information systems enhances the quality of health care services.	☐	☐	☐	☐	☐
REL2	EHIS minimizes patient information errors.	☐	☐	☐	☐	☐
REL3	Electronic health information systems help to maintain reliable medical records.	☐	☐	☐	☐	☐
REL4	EHIS systems enhance uniformity of health care service.	☐	☐	☐	☐	☐
REL5	EHIS supports the provision of accurate services to healthcare	☐	☐	☐	☐	☐

	providers.					
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C. Responsiveness

Table 5. Responsiveness Dimension

No.	Statement	1	2	3	4	5
RES1	EHIS minimizes patients wait time.	☐	☐	☐	☐	☐
RES2	EHIS will enhance the timeliness of health services.	☐	☐	☐	☐	☐
RES3	EHIS allows for rapid response to patients' needs.	☐	☐	☐	☐	☐
RES4	EHIS enhances communication between health care providers.	☐	☐	☐	☐	☐
RES5	EHIS helps to make timely healthcare decisions.	☐	☐	☐	☐	☐

D. Assurance

Table 6. Assurance Dimension

No.	Statement	1	2	3	4	5
ASS1	Use of electronic health information systems builds patients' trust in health services.	☐	☐	☐	☐	☐
ASS2	EHIS makes patient data more secure.	☐	☐	☐	☐	☐
ASS3	The electronic health information systems guarantee privacy of health information.	☐	☐	☐	☐	☐
ASS4	EHIS improves the practice of healthcare safety.	☐	☐	☐	☐	☐
ASS5	The use of electronic health information systems helps to build trust in health care at hospitals.	☐	☐	☐	☐	☐

E. Empathy

Table 7. Empathy Dimension

No.	Statement	1	2	3	4	5
EMP1	Information systems in health care are called Electronic Health Information Systems, which serve the delivery of patient-centered health care services.	☐	☐	☐	☐	☐
EMP2	Electronic health information systems assist health care providers to learn about patients.	☐	☐	☐	☐	☐
EMP3	EHIS systems, or EHS, enhance communication with patients.	☐	☐	☐	☐	☐
EMP4	PHS is enabled by EHI systems.	☐	☐	☐	☐	☐
EMP5	EHI systems have a positive impact on patients' health experiences.	☐	☐	☐	☐	☐