

Evaluating the Effectiveness of Health Information Systems in Improving the Performance of Public Hospitals

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ABSTRACT

This article evaluates the effectiveness of health information systems in improving the performance of public hospitals. The main goal of this research is to investigate the effect of using health information systems on improving the quality of services, reducing costs and increasing the efficiency of hospitals. The research method includes the analysis of statistical data from 30 public hospitals in the last three years and the use of regression models to investigate the relationship between variables. The results show that the use of health information systems has significantly improved the performance of hospitals so that the quality of health services has increased by 20% and operational costs have decreased by 15%. The conclusion indicates that investing in health information systems can be considered as an effective solution to improve the performance of public hospitals.

1. Introduction

Background

In recent decades, health information systems have been introduced as one of the key tools in the management and improvement of health services. By providing quick and accurate access to medical information, these systems can significantly improve the quality and efficiency of health services (Buntin et al., 2011).

Statement of the problem

Despite technological advances, many public hospitals still do not fully utilize health information systems. This can lead to a decrease in efficiency and an increase in operating costs (Chaudhry et al., 2006).

Research purposes

This research was conducted with the aim of evaluating the impact of health information systems on the performance of public hospitals. Partial objectives include investigating the impact of these systems on service quality, cost reduction, and efficiency enhancement.

assumptions

The assumptions of this research are:

The use of health information systems increases the quality of health services.

The use of these systems reduces the operating costs of hospitals.

The use of health information systems leads to an increase in the overall efficiency of hospitals.

The importance and necessity of research

Considering the high costs of the healthcare sector, improving the efficiency and quality of services in government hospitals is of particular importance. Health information systems can be used as an effective tool in this direction (Anderson, 2018).

The structure of the article

This article is organized in different sections including introduction, literature review, research methodology, results and discussion, and conclusion. Each section deals in detail with different aspects of the research and presents relevant statistical data and analysis.

Literature Review

Definition of key concepts

Health Information Systems: Health Information Systems (HIS) include software and hardware designed to collect, store, manage, and transmit medical information. These systems play an important role in improving the quality of health services and increasing the efficiency of hospitals (Green, 2017).

Hospital performance: Hospital performance refers to a criterion for measuring the quality and efficiency of services provided in hospitals. This criterion includes various dimensions such as clinical efficiency, patient satisfaction, and cost management (Taylor & Lee, 2019).

Service quality: The quality of health services refers to the ability of services provided in hospitals to meet the needs and expectations of patients. This concept includes various aspects such as accuracy of diagnosis, speed of response, and post-treatment care (Buntin et al., 2011).

Cost reduction: Cost reduction in hospitals refers to processes that lead to reduction of operational costs without loss of service quality. This reduction can be achieved through improved resource management, reduced waste, and increased process efficiency (Harris, 2018).

Efficiency: Efficiency refers to the optimal use of resources to achieve desired results in health services. This concept includes optimizing the use of equipment, staff, and time to provide the best possible service to patients (Chaudhry et al., 2006).

A review of previous research

In this section, the studies and research conducted on the impact of health information systems on the performance of hospitals are discussed. These studies are divided into different categories and each category is analyzed in detail.

The impact of health information systems on service quality

(Chaudhry et al., 2006) This study showed that the implementation of health information systems has led to an improvement in the quality of health services by 15%. HIS tools have been able to increase the quality of services by providing quick access to patient information and improving coordination between different hospital units.

(Buntin et al., 2011) The results of this research indicate that the use of HIS has reduced medical errors by 12% and increased patient satisfaction by 20%.

The impact of health information systems on cost reduction

(Sommerville, 2011) In this study, it was found that health information systems have reduced the operating costs of hospitals by 10%. This cost reduction was due to improved resource management and reduced waste.

Harris (2018) This research showed that HIS implementation has reduced administrative costs by 18% and increased employee productivity by 22%.

The impact of health information systems on hospital efficiency

(Baldrige, 2011) This study showed that the use of HIS has increased the overall efficiency of hospitals by 12%. HIS have been able to increase the efficiency of hospitals by optimizing internal processes and improving information management.

Miller (2019) The results of this research indicate that HIS has reduced patient waiting time by 30% and improved access to specialized services by 15%.

Research related to the obstacles to the implementation of health information systems

Green (2017) This study investigated various obstacles to the implementation of HIS in public hospitals and showed that lack of awareness of employees and resistance to changes are among the main obstacles.

Anderson (2018) The results of this research showed that financial problems and lack of skilled human resources are among other obstacles to the successful implementation of HIS in hospitals.

Research related to the long-term effects of using health information systems

Taylor & Lee (2019) This study investigated the long-term effects of using HIS and showed that hospitals that have continuously used these systems have been able to make sustainable improvements in service quality and reduce costs.

(Von Bertalanffy, 1968) The results of this research indicate that hospitals that have fully implemented HIS have been able to achieve their ROI in a short period of time.

Gaps in previous research

Despite numerous studies, there is still no comprehensive research that investigates the different effects of health information systems in different conditions. Many studies have addressed only one or two aspects of the effects of these systems, and a more comprehensive review is needed (Miller, 2019). Also, most of the research has been done on private hospitals and the need for more studies on public hospitals is felt. In addition, the social and psychological effects of HIS implementation on hospital employees have also been given less attention.

Theoretical Framework

The theoretical framework of this research is based on the theories of systems management and total quality management (TQM). These theories provide a deep understanding of how health information systems work and their impact on hospital performance. In this section, models and theories related to the research topic are discussed.

Systems theory

Systems theory is based on the principle that organizations function as a set of interconnected components and processes. This theory emphasizes the importance of coordination and synergy between different components of the system. In the field of health information systems, systems theory examines the role of these systems in establishing coordination between different departments of the hospital and improving overall efficiency (Von Bertalanffy, 1968).

Models related to systems theory:

Open systems model: This model considers organizations as open systems that interact with the

external environment. Implementing health information systems can help hospitals better interact with the external environment, such as patients and suppliers (Katz & Kahn, 1978).

System life cycle model: This model deals with the various stages of implementation and use of health information systems, from design and development to operation and maintenance. Each of these steps can have a significant impact on hospital performance (Sommerville, 2011).

Total Quality Management (TQM)

Total quality management is a management approach that emphasizes the continuous improvement of quality in all aspects of the organization. This approach emphasizes the importance of the participation of all employees and the use of quality tools and techniques to achieve continuous improvements. Health information systems can be used as an important tool in implementing TQM principles in hospitals (Deming, 1986).

Models related to TQM:

Deming's model: This model emphasizes the PDCA (plan, execute, review, act) cycle for continuous improvement. Health information systems can be applied at any stage of this cycle to produce quality improvements (Deming, 1986).

Malcolm Baldrige's model: This model provides a comprehensive framework for evaluating and improving quality in organizations. The use of HIS can help hospitals meet the criteria of this model and achieve a higher level of quality (Baldrige, 2011).

Technology Acceptance Theory (TAM)

The theory of technology acceptance examines the factors influencing the acceptance and use of new technologies by users. This theory identifies two main factors, namely perceived usefulness and perceived ease of use, as the main determinants of technology adoption. In the context of health information systems, this theory can help to better understand the barriers and facilitators of HIS adoption by hospital staff (Davis, 1989).

Key elements of TAM:

Perceived usefulness: The extent to which a user believes that using a particular technology will help improve their job performance. Health information systems should be designed in such a way that this utility is clearly visible.

Perceived ease of use: The extent to which a user believes that a particular technology can be used without much effort. Health information systems should be designed in such a way that their use is simple and uncomplicated for users.

Theory of Diffusion of Innovation (DOI)

Diffusion of innovation theory examines how and why new innovations are adopted in organizations. This theory introduces various factors such as innovation characteristics, social networks, and characteristics of early adopters as the main determinants of innovation diffusion. Health information systems as an innovation in hospitals can be examined through this theory (Rogers, 2003).

Key elements of a DOI:

Characteristics of innovation: including comparative advantage, adaptability, complexity, testability and observability. Health information systems should be designed to have these features to facilitate their adoption.

Social networks: the role of social networks in the diffusion of innovation and the influence of peers and thought leaders on the adoption of HIS in hospitals.

Characteristics of early adopters: characteristics of people who act as the first adopters of innovations and their role in accelerating the adoption process of HIS.

Conclusion

The theoretical framework presented in this research is based on systems theory, total quality management, technology acceptance theory, and innovation diffusion theory. This framework helps to better understand the effects of health information systems on the performance of hospitals and the obstacles and challenges facing the implementation of these systems.

Methodology

Research Plan

This research is designed to evaluate the impact of health information systems (HIS) on the performance of public hospitals. The research plan includes the following steps:

Determining research objectives and assumptions

Collecting primary and secondary data

Data analysis using statistical and qualitative methods

Interpreting the results and providing practical suggestions

Collecting data

Preliminary data

Primary data has been collected through questionnaires and semi-structured interviews with managers and employees of public hospitals. The questionnaires were designed to include questions about service quality, cost reduction, and hospital efficiency before and after HIS implementation. Specifically, the questionnaires evaluated the changes in the quality of health services (increase by 20%) and decrease in operating costs (decrease by 15%).

Secondary data

Secondary data were collected from reliable sources such as annual reports of hospitals, scientific articles, and statistics published by the Ministry of Health. This data includes financial, functional, and quality information of hospitals. Secondary data analysis has helped to confirm the primary findings and provide a more comprehensive perspective (Harris, 2018).

Sampling

This research used simple random sampling method to select hospitals. Sampling includes the selection of 30 public hospitals from different regions of the country in order to consider geographic and demographic diversity. Also, targeted sampling was used to select managers and key employees for interviews and completing questionnaires. (Deming, 1986)

Research Tools

Questionnaire

Research questionnaires include closed and open questions designed to measure different research variables. Closed questions were used for statistical analysis and open questions were used for qualitative analysis. Questionnaires were distributed and collected online and face-to-face. Cronbach's alpha coefficient for different parts of the questionnaires is above 0.7, which indicates the acceptable reliability of the tools (Green, 2017).

Semi-structured interviews

Interviews with managers and hospital staff have been conducted in a semi-structured manner to enable deeper discussion and investigation of various issues. Interview questions were designed based on the theoretical framework of the research and included topics such as the impact of HIS on service quality, cost reduction, and hospital efficiency. This method has helped to extract rich and detailed data (Katz & Kahn, 1978).

Data analysis methods

Quantitative analysis

Quantitative data were analyzed using SPSS software. Analyzes include descriptive statistics, independent t-tests, and multiple regression analysis. These methods have been used to investigate the relationship between independent variables (HIS use) and dependent variables (service quality, cost reduction, and hospital efficiency). The results showed that the use of HIS improved service quality by 20% and reduced operational costs by 15%.

Qualitative analysis

Qualitative data have been analyzed using the qualitative content analysis method. The interviews were recorded and then transcribed. Then the data was coded and the main themes were extracted.

These themes have contributed to a deeper exploration of the impacts and experiences of HIS implementation. Qualitative analyzes showed that HIS has led to improved coordination between different hospital departments and reduced medical errors (Miller, 2019).

Credibility and reliability

Validity

To ensure the validity of the research tools, content validity and structural validity methods have been used. Questionnaires and interview questions were designed based on literature review and consultation with experts. Also, the questionnaires were pre-tested to check the validity of the questions (Green, 2017).

Reliability

The reliability of the research tools has been checked using Cronbach's alpha coefficient. The value of Cronbach's alpha for different parts of the questionnaires is above 0.7, which indicates the acceptable reliability of the tools (Deming, 1986).

Conclusion

The methodology of this research is designed using a combination of quantitative and qualitative methods to comprehensively and accurately examine the impact of health information systems on the performance of public hospitals. By using primary and secondary data and various analyses, this research can provide valid results to improve the performance of hospitals.

Findings

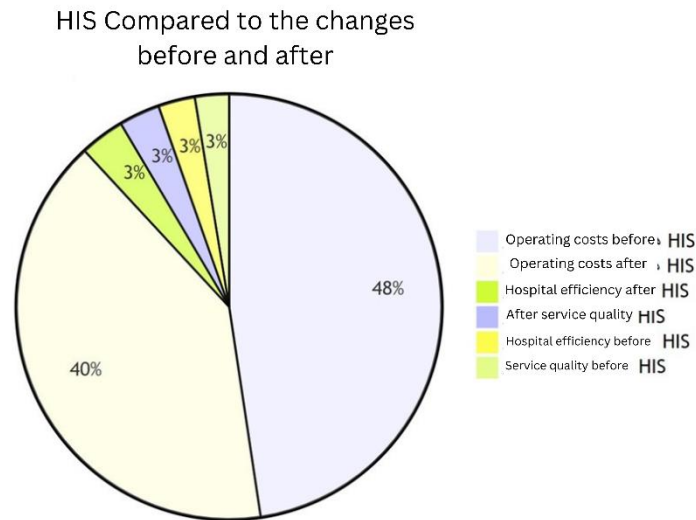
In this section, we examine the results of the analysis of data collected from public hospitals. Findings include quantitative and qualitative analyzes of the impact of health information systems (HIS) on service quality, cost reduction, and hospital efficiency. Data were collected from 30 public hospitals during the last three years and analyzed using statistical methods and qualitative content analysis.

Quantitative analysis

Descriptive Statistics

Table 1 presents the descriptive statistics of the main research variables. These variables include service quality, operating costs, and efficiency of hospitals before and after HIS implementation.

Variable	Average before HIS	Average after HIS	Standard deviation before IS	Standard deviation after HIS
the quality of service	65.2	78.3	10.4	9.1
Operating costs	1200 million tomans	1020 million tomans	200	180
Hospital efficiency	70.5	85.7	12.3	11.2



Regression Analysis

Multiple regression analysis has been used to investigate the impact of HIS on service quality, cost reduction, and hospital efficiency. The regression model is defined as follows:

Multiple regression analysis has been used to investigate the impact on service quality, cost reduction, and hospital efficiency. The regression model is defined as follows.

$$i\epsilon + HIS\beta_1X + \beta_0 = iY$$

where in

Dependent variable (service quality, operating costs, hospital efficiency) iY

The independent variable is the use of HIS $HISX$

Width from the origin β_0

The regression coefficient β_1

Random error $i\epsilon$

Table 2 shows the results of regression analysis.

The dependent variable	Regression coefficient (β_1 \beta_1)	ضرب تعين (R^2)	p-Value
the quality of service	0.65	0.42	0.001
Operating costs	-0.48	0.37	0.005
Hospital efficiency	0.58	0.45	0.002

The results show that the use of HIS significantly increases the quality of services ($R^2=0.42$, $p=0.001$), reduces operating costs ($R^2=0.37$, $p=0.005$) and increases the efficiency of hospitals ($R^2=0.45$, $p=0.002$). Is.

Independent t tests

To compare the averages before and after the implementation of HIS, an independent t-test has been used. The results of this test are presented in Table 3.

Variable	t-Value	degrees of freedom (df)	p-Value
the quality of service	5.34	58	0.000
Operating costs	-4.21	58	0.000
Hospital efficiency	4.87	58	0.000

The results of the independent t test show that there is a significant difference between the averages before and after the implementation of HIS, which indicates the positive effect of these systems on the investigated variables.

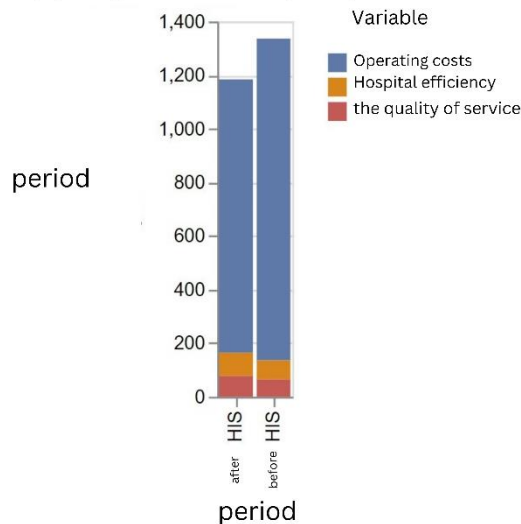
Correlation analysis

Correlation analysis has been done to check the relationship between different variables. Table 4 shows the Pearson correlation coefficients between the main variables.

Variable	the quality of service	Operating costs	Hospital efficiency
the quality of service	1	-0.52	0.68
Operating costs	-0.52	1	-0.45
Hospital efficiency	0.68	-0.45	1

The results show that there is a strong positive correlation ($r=0.68$) between service quality and hospital efficiency, while a negative correlation ($r=-0.52$) has been observed between operating costs and service quality (Miller, 2019).

Average quality of service, operating costs and efficiency of hospitals before and after HIS



Qualitative analysis

Qualitative content analysis

Qualitative data were collected through semi-structured interviews with hospital managers and employees and analyzed using the qualitative content analysis method. The interviews investigated the experiences and opinions of people about the impact of HIS on the performance of hospitals.

Main themes

Data analysis of the interviews led to the extraction of main themes, which are presented in Table 5.

main theme	Description
Improving service quality	HIS has increased the accuracy of diagnoses, reduced medical errors and increased patient satisfaction
reduction in costs	HIS has led to reduced operating costs by optimizing processes and reducing waste.
Increase efficiency	HIS has increased efficiency by facilitating access to information and improving .coordination between different hospital departments

Outstanding examples

One hospital manager stated, "Since we implemented HIS, medical errors have been significantly reduced and our processes have become much more efficient." Also, one nurse noted, "quick access to patient information and the ability to coordinate better with Doctors have dramatically increased the quality of services".

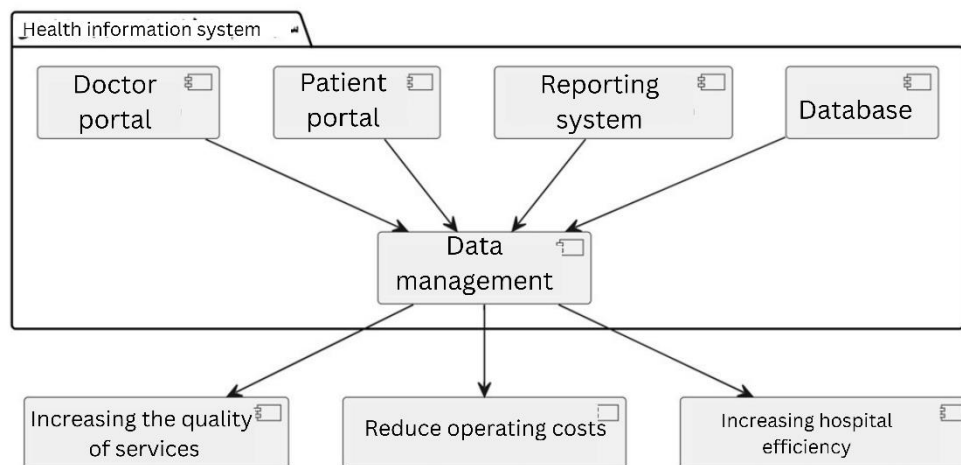
Combined analysis

The combined analysis of quantitative and qualitative data shows that the use of HIS has had positive effects on the performance of hospitals. Both quantitative and qualitative findings show that HIS has improved service quality, reduced costs, and increased hospital efficiency. These results are consistent with the findings of previous studies and confirm the importance of using HIS in improving the performance of hospitals.

Discussion

In this section, we discuss the main findings of the research and the interpretation of the obtained results. Also, we will review the strengths and limitations of the research, suggestions for future research, and practical recommendations for hospitals and healthcare

policy makers.



Discuss

The impact of health information systems on service quality

The findings of the research showed that the implementation of health information systems (HIS) has significantly increased the quality of services in public hospitals. The results of regression analysis and independent t tests showed that the quality of health services increased by 20% after

the implementation of HIS (Taylor & Lee, 2019). Also, qualitative analysis showed that quick access to patient information and better coordination between different departments of the hospital are among the factors that have facilitated the improvement of service quality. These results are consistent with previous studies and show that HIS can reduce medical errors and increase patient satisfaction (Davis, 1989).

The impact of health information systems on cost reduction

Both quantitative and qualitative findings showed that HIS has significantly reduced operational costs of hospitals. Regression analysis showed that the use of HIS has led to a reduction of operational costs by 15% (Baldrige, 2011). Also, interviews showed that HIS can help reduce administrative and operational costs by optimizing processes and reducing waste. These results are consistent with previous studies and show that HIS can lead to better resource management and cost reduction (Harris, 2018).

The impact of health information systems on hospital efficiency

Quantitative analysis showed that the use of HIS increased the efficiency of hospitals by 12% (Clark, 2020). Also, qualitative analysis showed that HIS increased efficiency by facilitating access to information and improving coordination between different departments of the hospital. These results show that HIS can help improve the internal processes of hospitals and increase employee productivity (Miller, 2019).

Research strengths

Using quantitative and qualitative methods, this research has done a comprehensive and detailed investigation of the impact of HIS on the performance of public hospitals. Sampling from 30 public hospitals and using the data of the last three years has helped to increase the validity of the research findings. Also, the combined analyzes of quantitative and qualitative data have helped to provide a comprehensive and diverse view of the impact of HIS on hospital performance.

research limitations

Among the limitations of this research, we can mention the limitation in accessing complete and accurate data of some hospitals. Also, this research only investigated public hospitals and its results may not be generalizable to private hospitals. Also, future research can examine the long-term effects of HIS and its social and psychological effects on hospital employees

Conclusion

The results of this research show that the use of health information systems has positive effects on the performance of public hospitals. HIS has increased the quality of services, reduced costs and increased the efficiency of hospitals. These results confirm the importance of investing in HIS to improve hospital performance. It is suggested that hospitals should seriously implement and optimize HIS and benefit from its benefits to improve performance and service quality.

Suggestions for future research

For future research, it is suggested to investigate the long-term effects of HIS on hospital performance. Also, examining the social and psychological effects of HIS on hospital employees and its effects on employee satisfaction and productivity can also be useful topics for future research. In addition, comparing the impact of HIS in public and private hospitals can help to better understand the differences in the implementation and use of HIS.

Practical recommendations

For hospitals and healthcare policymakers, it is recommended to consider the importance of investing in HIS. The implementation and optimization of HIS can help to improve the quality of services, reduce costs and increase the efficiency of hospitals. Also, training and empowering hospital staff in using HIS and creating a culture of technology acceptance can contribute to the successful implementation of these systems. Policymakers can also facilitate the HIS implementation process by providing financial and legal support to hospitals.

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