The Impact of Information Technology on Health Sector Performance: Case Study – Saudi Arabia Health Sector.

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ABSTRACT

This research demonstrates the importance of information technology in the health sector and the role of information systems and their use in medicine. Also this paper will describe the importance of information systems in health sector and the challenges that may be faced. The health sector in Saudi Arabia has a good technology base for saving, retrieving, and exchanging information but there still there is no centralized information system and the sector as a whole is not taking the maximum benefits from existing health information systems. The main objective of this study is to know the impact of information system management on the health sector and how to utilize benefits from applying this technology. This study uses a questionnaire as a quantitative approach to investigate informational technology features. The questionnaire was distributed among different organizations in the health sector such as hospitals, medical centers, and different departments, then the data was collected and analyzed. The majority of the study population agreed with the services that computers provide in achieving tasks and the importance of health information systems (HIS). At the end of the research recommendations are presented to enhance and develop the usage of applying HIS in Saudi health sector.

(Keywords: health sector, health information systems, HIS, technology in health care, centralized data systems, electronic health records, EHR)

INTRODUCTION

The current management in health care organizations faces a challenge because of the rapid change and development in technology, which complicates information requirements in support of health missions. The traditional methods which depends on personal experts alone is no longer a suitable way to achieve organization objectives which requires efficient decisions in choosing suitable human resources and financial resources in health organizations.

Decision making processes become the heart of the management challenge and is the way to achieve the objectives of organization during different stages such as planning, organizing, directing, and monitoring throughout the entire structure of the organization. The 21 century, considered as the knowledge age, has shown that the effective management of information influences all aspect of life and is considered as the main source for assisting in decision making processes which are complex. Information availability in suitable time can reduce this complexity. Information system can be considered as a strategic tool which increases the productivity and effectiveness of organizations and can be used to enhance the competiveness of organizations.

Health care is considered by many as one of the most important issues for humanity, both in terms of societal and life goals. The relationship between information technology and health care is a mutual relationship. The health care sector needs accurate information, and accurate information cannot be achieved unless we have good health in our brains, body, and psychology (Alfarra, 2011).

The impact of information technology (IT) on the health sector relies on the importance of the relationship between them. IT has a major role in improving and streamlining operational efficiencies in the health system. The role of IT in health sector organizations is to reduce the complexity of the work, assist in moving to paperless operations, and to get rid of legacy system. Also it helps in automating data and process in hospitals referring to patient electronic

health records (EHR), pharmacy information systems, and secure patient confidentiality (Lorenzi and Riley, 2004).

HEALTH INFORMATION SYSTEM (HIS)

This study describes the importance of information in the health sector and the role of computers and their use in medicine through information systems. Also it will describe the challenges that may be it faced in health systems. The goal of an HIS is to allow decisions to be made in a transparent way, based on evidence. Therefore, the objective of the HIS is to produce relevant and high quality information to support medical and managerial decision making (Health Metrics Network 2006).

Information management's main concern is to obtain information, then manage it, and then use it, in order to enhance the healthcare sector. There is no value for an HIS unless the information is obtained supports the mission of the organization. The information is considered as the main source for the human health management and the success of any organization. We should look to the HIS as an integrated system starting from the personal data for patients, clinical data, and then transforming data to information to help in decision making, planning, and development.

The quality of data and transforming it to information is very important. An HIS can be defined as "a set of components and procedures organized with the objective of generating information which will improve health care management decisions at all levels of the health system" (Lippeveld, Sauerborn, and Bodart, 2000).

Describing HIS in any certain country is to regard the dimensions of request such as: the purpose of data and the person who needs data, tools, and methods available to generate the needed information, and the level of the health system at which data are generated and used (Abou, Zahr and Boerma, 2005). The performance of an HIS can be referred to two determinants:

- Technical determinants: for example data quality, system design, or adequate use of information technology.

- Other determinants are also involved, such as (1) organizational and environmental determinants that relate to the information culture within the country context, the structure of the HIS, the roles and responsibilities of the different actors and the available resources for HIS, and (2) the behavioral determinants such as the knowledge and skills, attitudes, values, and motivation of those involved in the production, collection, collation, analysis, and dissemination of information (Lafond and Field, 2003).

Benefits of Health Information System

According to the Agency for Healthcare Research and Quality (2006) , there are two types of benefits:

- **Quantitative Benefits:** which is return to financial benefits that can be measured easily due to the use of technology such as the unified Patient Electronic Record System that can be used in the country. Another example is exchanging electronic information about certain disease to save efforts and time.

- **Qualitative Benefits:** which are benefits that can be caused directly or indirectly by information system but it can't be estimated quantitatively such as the accurate of information, speed of exchanging information, and bandwidth capacity.

HOSPITAL INFORMATION SYSTEMS (HoIS)

Hospital Information Systems (HoIS) transfer patient administrative functions such as patient profile information, scheduling of appointments, billing from traditional (manually) through automated techniques. Healthcare organizations always adopt emerging information technologies applications in an endeavor to allow the managers and health professionals, access to general and specific the patients' information for improving efficiency and quality of patient care (Behkami and Daim, 2011).

Through HoIS doctors and nurses are able to track the patient's care electronically. The main benefit of a HoIS is the documentation of clinical activities. Hence, the involvement of doctors and nurses in the use of HoIS is the most important factor, and a constant issue in acceptance of IT

(Bernstein and McCreless, 2007). Doctors and nurses can better appreciate the advantages of technology if they accept and integrate said technologies into their daily work (Ellahi & Manarvi,2010). The healthcare industry is considering a wide variety of emerging information technologies applications in an effort to enable the key players, health professionals, access to general and specific the patient's information for improving efficiency and quality of patient care (Behkami and Daim, 2011).

Patient Electronic Record System

An electronic health record (EHR) may be defined as an information source in electronic form which contains identifiable information concerning a patient's medical care, and which is used to enable quality and continuity of care, and provide a record of care should subsequent queries arise(Goundrey-Smith,3013). The EHR may include, but is not restricted to: diagnoses, medical history, allergies, ADRs, results of pathology and other test, and prescribing history.

Characteristics of Patient Electronic Record System

- **Paperless System:** getting rid of paper increases the speed of saving and retrieving information.
- **Considered as the meeting point for all other systems**: because all medical information about patient is saved in this record.
- **Research Supportive:** It can be used for developing scientific research, because all information is saved in this record.

Pharmacy Information System (PIS)

Currently health system managers consider the performance of pharmacy operations as the influential factor in health system achievement to carry patients effectively (Anoye, 2008). Hospital pharmacy departments take part in supplying health care services by covering all aspects of medicine use including selection, preparation, distribution, prescription, and administration of medication and lastly observing of patient results (EAHP, 2008). Increasing the quality of health care system by using HIS can be considered as a valuable strategy (Mark and Kazley, 2011).

Hospital PISs are considered as one of the most important applications of information technology that helps in reaching the efficiency, effectiveness, service quality goals and the patients' level of satisfaction (Geisler and Heller, 1998). A PIS examines and confirms all the policies related to the medication use process (Wolper,2003), supplies patients, pharmacists, physicians and nurses with precise and full medication information to fulfill medication care needs (ASHP, 1995). A PIS also makes the practitioners and professionals aware of the unsafe coefficient of the medications, overdose prescriptions, potential interacting effects of prescribing two medications simultaneously (Manno, Hogan, et al., 2006).

RESEARCH OBJECTIVES

The main objective of this research is to know the impact of information system management on the health sector. Some sub-division questions branches from main objective:

1. To know the state of the information system management in the health sector in Saudi Arabia.
2. To know the evaluation and feedback of the sample study people about the degree that they take benefit of information system management in Saudi health sector.

Importance of the Study

- The importance of information system management in developing the managerial issues in the health sector.
- The rapid development in information system and their benefit to aid in managing health sector organizations.
- The need to develop information system in Saudi health sector.

Problem Statement

The organizations in the Saudi health sector have a media for saving and retrieving information but

there is not enough concentration on information systems. According to the study that author made, there is no separate and centralized information system in the health sector organizations, and instead it is distributed in different departments without any development.

Research Questions

According to problem statement the main question raised:

What is the impact of information systems on health sector organizations?

There are also some sub- questions of the main question:

1. What is the situation of information system management in Saudi health sector in Jeddah organizations?

2. What is the evaluation of the sample study people about the degree that they take benefit of the information system management in their career?

Research Hypotheses

H1: There is a Positive Relation between managing information and health information systems.

H2: There is a Positive Relation between existences of information departments and health information systems.

H3: There is a Positive Relation between methods of obtaining information and health information systems.

H4: There is a Positive Relation between exchanging Information with decision makers and health information systems.

H5: There is a Positive Relation between computers helping in achieving tasks and health information systems.

Research Model

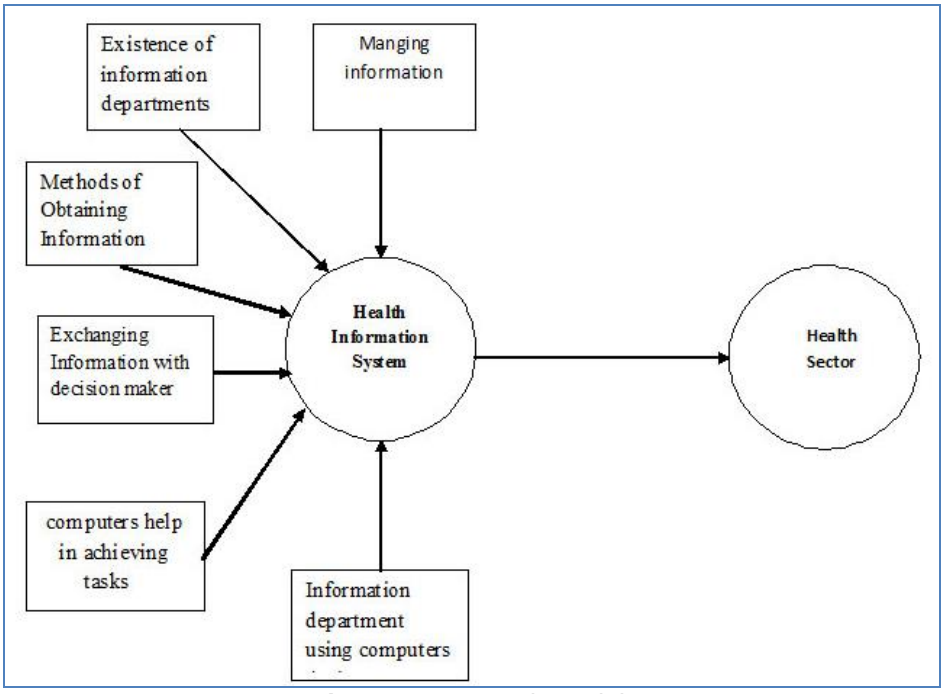

Figure 1: Research Model.

RESEARCH METHDOLOGY

Research Approach

The researcher adopted a quantitative approach in this study which comprises of survey about features and variables and their relations, where features are classified, analyzed, and statistical models are constructed to justify what is observed. Quantitative research starts from a certain hypothesis that must be confirmed or refused. According to Brown and Lloyd (2002) quantitative approaches use large random samples that is representative of the general population. Quantitative analyses results can be generalized to a larger population and make the comparison of different attributes very easily (LAMEL, 2007).

Study Tools

The author depended on a questionnaire as a tool in this study which is considered as the most popular usage in scientific research and considered as one of the best methods used in collecting data and it is suitable for this study. Questionnaire is defined as a set of questions distributed on a sample of people, with a purpose of collecting information about the people's attitudes, behavior, beliefs, etc. about a certain subject (Lanthien, 2002). A survey has been made for Saudi health sector organizations to investigate the relationship between information technology and health sector services. The questionnaire approach has a lot of advantages including low cost, it doesn't need highly skilled researcher, the privacy of the respondents is protected, large numbers of population can be covered, and it depends on the statistical analysis which leads to easy comparison between results. In contrast it requires a good design for questions in order to be suitable for respondents to get the best result (Saunders et al., 2007).

Designing the Questionnaire

During the building of the study questionnaire, the researcher depended on the stated research problems, objectives, questions, and the theoretical and previous study outlined earlier in this paper. Questions were revised by experts until they reach final shape which consists of two parts:

First part: general information about the sample of the study such as the level of management, region, occupation, education level, courses in computer science, experience in managerial work.

Second part: Consists of the situation of information system management in Saudi health care sector which contains the following:

1. Information management in your organization
2. The presence of HIS in your organization/department
3. The means used to provide information to the health sector.
4. The means that information management are used to provide information to decision makers.
5. The computers available in your office to help you in achieving your tasks.
6. The information management in your organization used in achieving its tasks.

RELIABILITY AND VALIDITY

“Reliability and validity are tools of an essentially positivist epistemology” (Winter, 2000). The quality of any research result depends on its reliability and validity. Reliability is the amount of precision of gathered data, in contrast validity measure to what degree the object is measured as it was planned to be.

Validity

Validity in quantitative research determines whether the research truly measures that which it was intended to measure or how truthful the research results are (Joppe, 2000). Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research of others. Validity discusses whether the results are about what researcher suggest or not. Iternal validity in relation to Qyestionnaire as ability of Questionnaire to measure what you intend it to measure (Saunders et al., 2007).

Reliability

Joppe (2000) defines reliability as: the extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable.

According to Yin (1994), the role of reliability is to minimize the error and biases in a study. Also reliability refers to the extent to which your data collection techniques or analysis procedures will yield consistent findings. Cronbach's alpha is one of the methods that used for measuring the consistency reliability (Saunders et al., 2007). The result of reliability in this study shown in Table 1.

DESCRIPTIVE ANALYSIS

The Population of The Study

The population of the study as shown in Table 1.

Table 1: Population of Study.

Role	Number
Manager of Hospital	7
Head of Departments	70
Consultants	125
Doctors	98
Total	**300**

The Sample of the Study

By using the random sample method, the author chose managers and heads of departments from different hospitals in Saudi Arabia in an average of 8 questionnaires for each main hospital and 9 questionnaires for each hospital in main city. After the questionnaire collection process and deleting unsuitable questionnaires, the total of remaining questionnaires was 300.

Sample of the Study Distribution According to Occupation

Table 2: Sample of the Study Distribution.

Occupation	Numbers	Percentage
Hospital manager	6	2%
Head of departments	68	22.66%
Consultants	128	42.66%
Doctors	98	32.66%
Total	**300**	**100%**

According to Table 2, it appears that the ratio of hospitals manager is the least and the largest ratio for consultants.

Sample of Study Distribution According to Level of Education

Table 3: Sample of Study Distribution According to Level of Education.

Level of Education	Numbers	Percentage
Ph.D.	25	8.33%
Master	20	6.66%
Bachelor	240	80%
Other	15	5%
Total	**300**	**100%**

According to Table 3, it appears that Ph.D. holders' numbers are more than master degree but the majority of the sample study levels of education are bachelor degree holders.

Distribution of Sample According to the Courses in Computers

Table 4: Distribution of Sample According to the Courses in Computers.

Courses in Computer Science	Numbers	Percentage
No courses	48	16%
One course	96	32 %
Two courses and above	156	52%
Total	**300**	**100%**

According to Table 4, the number of employees that taken courses is large. Above 83% of the sample have taken one course and above. The percentage of employees that taken two courses and above are half of the sample.

Distribution of the Sample According to Years of Experience

Table 5 distribution of the sample according to years of experience.

Years of Experience	Numbers	Percentage
Below five years	75	25%
From five years up to less than ten years	81	27%
From ten years up to less than 15 years	93	31%
From 15 years and above	51	17%
Total	**300**	**100%**

According to Table 5, it appears that most of the sample in this study has over five years of experience in managerial work.

RESULTS AND ANALYSIS

In this chapter the researcher presents, analyses, and discusses the results through answering the main question of this research:

What is the situation of information system management in Saudi health sector in Jeddah organizations?

Managing Information in your Organization

The statement that measure processing techniques of information in departments and the answers as shown in Table 6.

According to Table 6, we can analyze and get the following results:

- For variable number one which asks about the existence of achieving systems, the majority 48.8% of the sample said that yes but it managed manually. On the other hand 22.5% said that yes it managed both manually and automatically, 8.4 % indicated that it is managed automatically. Opposite to them 20.3 % mentioned that there is no such department in this name.

- For variable number two which asked about the existence of file systems, the majority with a percentage of 60.6% said that it is exists and it is managed manually, 31.4% said yes and it is managed automatically, 21.6% answered yes it is managed both manually and automatically, on the other hand 4.4% answered no. From these results we conclude that majority said that there are departments of files but there answers diverse about if it is manually or automated managed.

- For variable number 3 which discussed the existence of an information center, 45.3% of the sample said that there is no such department in their organizations, 24.1% mentioned that yes it is available and it is managed manually , 5.16 % mentioned yes it is available and it is managed automatically, 14.4% mentioned that it is exist and managed manually and automated. From these results we can conclude information center exists in some organizations and is not found in others.

- For variable number four which discusses the existence of an Information Center and computers, 47.2% mentioned that it exists and is managed automatically and also others mentioned it is managed both automatically and manually. These opinions may refer to the difference in employee views about this department.

Existence of Information Departments

There are three questions to measure this construct as follows (Table 7):

Table 6: Processing Techniques of Information in Departments.

Variable	Information management	No		Yes				
				Both		Automatic	Manually	
		%	number	%	number	%	%	number
1	Achieving	20.30	65	22.5	72	8.4	48.8	156
2	Files	4.4	14	21.60	69	13.4	60.60	194
3	Document Center	45.30	145	14.4	46	16.30	24.1	77
4	Existence of Information Management Center	52.8	169	11.30	36	28.40	7.5	24

Table 7: Existence of Information Departments.

Variable	Information management	No		Yes	
		%	number	%	number
1	Separate Management	49.06	157	50.94	163
2	Distributed among Different Departments	33.44	116	66.56	213
3	There is in Each Department its own Information Center	71.56	228	28.44	91

According to results in Table 7, the following finding are discovered:

- The percentage of the sample respondents and answers are close for variable number one which asks about the existence of information management as a separate management structure. The reason for these results is that health sector organizations don't adopt the same model and structure for information management, and in some organizations it is separate and in others is distributed among the other departments.

- The majority of the sample responses about variable number two indicate that most of information management is distributed among different departments.

- The majority of the sample responses about variable number three say no which was asking about the existence of separate information centers for each information department.

- The majority of the sample responses about variable number four say yes which is asking about existence of special information centers for some departments.

Methods of Obtaining Information

The statement that measures obtaining information consists of 6 variables as shown in Table 8. We conclude from these responses that the majority indicated that they obtain information through consultants, secondly through Health Sector Organization reports, and thirdly by electronic information exchange through internet.

Means of Exchanging Information with Decision Makers

The statement that measure Processing Means of Exchanging Information with Decision Makers and the answers is shown in Table 9. From table 9 we conclude that organizations in the health sector use all means of exchanging information such as: paper, telephone, and electronic means, but recently concentrating on electronic means and this is considered as positive point.

Second Question : What is the evaluation of the sample study people about the degree that they take benefit of the information system management in their career?

Table 8: Methods of Obtaining Information.

Variable	Methods of Obtaining Information	No		Yes	
		%	number	%	number
1	Consultant Reports	11.25	36	88.75	284
2	Health sector organization reports	22.5	72	77.5	248
3	Field research	58.75	188	41.25	132
4	Electronic exchanging through internet	40.63	130	59.38	190
5	Journals	71.56	229	28.44	91
6	Periodic	29.69	95	70.31	225

Table 9: Means of Exchanging Information with Decision Makers.

Variable	Exchanging Information	No		Yes	
		%	number	%	number
1	Exchanging information by papers	13.44	43	86.5	277
2	Exchanging information by phone and fax	16.56	53	83.44	267
3	Exchanging information by computer networks and email	19.38	62	80.63	258

Table 10: Computers Helping in Achieving Tasks.

Variable	Computer Helping in Achieving Tasks	No		Yes	
		%	number	%	number
1	Achieving routine tasks, writing reports and saving data.	9.06	29	90.94	291
2	Getting information from your electronic departments.	42.5	136	57.50	184
3	Exchanging information with other electronic departments.	53.13	170	46.88	150
4	Exchanging information with other hospital by emails and other means.	38.44	123	61.56	197
5	Exchanging information with information center	56.25	180	43.75	140
6	Providing suitable alternatives for decision making after getting suitable information.	50.94	163	49.06	157

Table 11: Department of Information using Computers in Achieving Tasks.

Variable	Information management	No		Yes	
		%	number	%	number
1	Data Recording	1.63	**34**	89.83	**286**
2	Data Classification	15	**48**	85	**272**
3	Retrieving Data	8.44	**27**	82	**293**
4	Processing received data from field.	17.81	**57**	61.19	**263**
5	Providing Managers by needed Information	10.31	**33**	89.69	**287**

Computers Helping in Achieving Tasks

To answer this question, the author used statistical methods to know the real situation of management of information systems from the point view of health sector employees. As shown in Table 10 below. According to previous table, health sector organization use computer in achieving daily routine jobs such as writing reports, saving data, communicate with other hospitals by using emails and other techniques.

Department of Information using Computers in Achieving Tasks

The statement that measures the department of information using computers in achieving tasks and the answers are shown in Table 11. It is noticed from this data, departments of health sector use computers in achieving the following tasks in order: retrieving information, recording, saving data, providing information for managers, data classification, and processing data that obtained from the field.

RESULTS AND RECOMMENDATIONS

Results of Testing Reliability of Constructs by using Cronbach's Alpha

According to Table 12, the values of Cronbach's alpha range from 0.88 to 0.94 , these results are high and it means that the tool that was used in the study is reliable so we can depend on its results.

Results of Hypothesis Testing

The Results of Hypothesis Testing are shown in Table 13 below.

Results Analysis

From the results obtained in tables above we can conclude the followings :

- The responses of the population vary according to the independence of information management.
- The responses of the population vary according to the methods of obtaining information.
- Most of the study population indicated that their information management uses all methods (manual and automatic) to provide information to decision makers.
- The majority of the study population agrees with the services that computers provide to them in achieving tasks.

Table 12: Reliability by Cronbach's Alpha for Constructs.

No.	Constructs	Cronbach's Alpha
1	Managing information in your organization	0.92
2	Existence of information departments	0.94
3	The method that health sector organization obtaining information	0.88
4	The method that information department send and receive information to decision makers	0.9
5	The office computers help in achieving employee tasks	0.91
6	Information department use computer devices in achieving tasks	0.92

Table 13: Results of Hypothesis Testing.

Hypotheses	Results
H1: There is a Positive Relation between managing information and health information system.	Supported
H2: There is a Positive Relation between Existences of information departments and health information system	Supported
H3: There is a Positive Relation between methods of obtaining information and health information system.	Supported
H4: There is a Positive Relation between exchanging information with decision makers and health information system.	Supported
H5: There is a Positive Relation between computers help in achieving tasks and health information system.	Supported

RECOMMENDATION

- Unify the information departments into one single and independent department.
- Develop the health information system in hospitals.
- Activate the role of scientific researchers to get information from the field.
- Design a continuous mechanism for updating information in health sector departments.
- Make a training course for employees at all levels in using information technology.
- Capitalize on the benefits from communication infrastructure in telemedicine.

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