# Extent of Use, Perceptions, and Knowledge of a Hospital Information System by Staff Physicians

# Yaseen A. Hayajneh, Wail A. Hayajneh, Ismail I. Matalka, Harun Z. Jaradat, Zaher Q. Bashabsheh, and Muhammad S. Alyahya

Abstract—A computerized hospital information system (HIS) used to support clinical and administrative processes was implemented in a large Jordanian teaching hospital in 2003. Physicians' acceptance and perceptions of the HIS is known to be one important factor in influencing successful implementation of hospital information systems. The aim of this study was to describe physicians' use, perceptions, and knowledge regarding the implemented HIS. A descriptive survey design was used. The setting is a large teaching hospital. An investigator-developed questionnaire comprising 38 questions was distributed to a convenient sample of 29 staff physicians who practiced in the hospital in the periods before and after implementation of the system. Results indicate that staff physicians use the system and that access to information was improved as a result of the HIS. Other results and conclusions are discussed.

# *Index Terms*—Hospital Information System, Implementation, Jordan, Physicians.

#### I. INTRODUCTION

**H**OSPITALS are complex organizations with intensive information needs. Effective management of information within hospitals is crucial for higher service effectiveness and efficiency levels. HIS is a necessary component of modern hospital infrastructure. HIS is considered a prerequisite for the efficient delivery of high quality health care in hospitals [1]. The use of information technology in hospitals to improve quality and reduce costs dates back to the early 1960s [2]. A HIS is a comprehensive and integrated information system designed to store, manipulate, retrieve and use information concerned with the administrative and clinical aspects of a hospital. This encompasses paper-based information processing and computer-based information processing. This study is concerned with computerized hospital information systems.

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Y. A. Hayajneh is the Chairman of Health Services Administration Department, Faculty of Medicine, Jordan University of Science and Technology, Irbid, Jordan 22110. (phone: +962-2-7201000 Ext: 23690; fax: +962-2-7095010; email: yhay@just.edu.jo).

W. A. Hayajneh is the Assistant Dean, Faculty of Medicine, Jordan University of Science and Technology.

I. I. Matalka is the Chairman of Pathology and Laboratory Department, King Abdullah University Hospital, Jordan University of Science and Technology. Vendors and advocates of HIS argue that such systems promise to improve the quality of health care through improving access and storage of information, reducing errors, and facilitating access to current scientific information available in decision support systems. Another promised benefit of HIS is to improve the efficiency of health care provision through reducing resources depletion and better time management practices. Hospitals that have adopted information systems appeared to have lower costs than non adopting hospitals after three to five years of implementation [3] [4].

The evaluation of hospital information systems need to be multidimensional [5], covering many aspects including users perceptions, knowledge and use of these systems. Physicians role in the success of information systems in health care facilities is vital [6][7], but many physicians are reluctant to use them [8]. The aim of this study was to describe physicians' use, perceptions and knowledge regarding the implemented HIS at a large teaching hospital in north Jordan. More specifically, the objectives of the study were to describe the extent to which staff physicians use the system, their knowledge of the system capabilities and their perceptions of system's impact on certain aspects of hospital operation.

#### II. METHODS

#### A. Study Design, Sample and Population

A cross-sectional, descriptive survey design was used to collect data needed to answer research questions. The population consists of all staff physicians employed by the hospital at the time of data collection and who were employed by the hospital during the period before and after its implementation. A convenient sample of 29 staff physicians participated in the study and completed study questionnaire. The sample constitutes 35% of the eligible population (82 staff physicians). Eligible population included all staff physicians who practiced in the hospital before and after the implementation of the system. The survey was carried out in March 2006.

H. Z. Jaradat is the head of systems and applications division, information systems department, King Abdullah University Hospital.

# B. Setting

The study was conducted in a 416 bed hospital that serves a population of more than 1.8 million, and providing hospital care services to an average of 355 inpatients and 1100 outpatients daily. The hospital includes departments of cardiology, general surgery, special surgery, internal medicine, gynecology, Ear-Nose-Throat, ophthalmology, pediatrics, orthopedics, oncology, and intensive care units. These services are supported by well equipped laboratory and radiology departments.

# C. Hospital Information System

A fully integrated computer system was implemented in the hospital starting February 2003. The HIS is available on more than 400 terminals throughout the hospital. Hospital IT team worked in conjunction with HIS vendor, and was also responsible for communicating with and training the users.

Clinical as well as administrative applications were implemented. These applications are:

- Master Patient Index; this provides a record of all patients registered at the hospital, through a unique identification number. It holds demographic, financial and medical details which are of long term significance.
- Duplicate Registration; this searches for probable duplicate records based on user-selectable criteria. It allows for confirmation and merging / removal of duplicate records
- Patient File Management; this assists the Medical Records department in tracking of patient folders across wards, clinics, doctors, service departments and external locations.
- Appointment Scheduling Application; this allows flexible scheduling of clinics and doctors to enable booking of outpatient appointment, generation of appointment slips / letter, confirmation/ rescheduling / cancellation of appointments.
- Outpatient Management Application; this provides for registering of outpatient visits of various clinics either as walk-in or with appointments, once registered, the consultation / treatment information can be undated for the current visit with a facility to view the past history.
- Inpatient Management Application; this helps in streamlining the patient admission, transfer and discharge processes including booking for beds. It provides for ward / bed assignment and management and produces bar-coded label and admission forms to facilitate proper identification of patients.
- Patient Billing Application; this provides a flexible and comprehensive means of tracking and consolidating patient charges from the time of patient registration to the time of discharges.
- Insurance Management Application; this helps in managing the insurance of patients for approvals, co-payments, deductibles, coverage and exclusions.

- Accounts Receivable Application; this helps in tracking of receivables from debtors. It helps in receipt management, journal entries, automatic production of reminders and account statements.
- Electronic Clinician Access Application; this includes: Clinical Access-Base module which entails care providers easy access to patient's clinical and demographic information thereby assisting them in performing their work more efficiently through a single point; and Clinical Documentation module that facilities point of care documentation based on user definable templates and standard word processing facilities thus eliminating the need for post care transcription.
- Order Entry Application; this maintains requests made from wards, clinics and departments for various services. Results can be entered using word processing facilities or accessed from relevant modules including interface to analyzers.
- Operation Theatre Application; this maintains theatre reservation details, performs on-line scheduling of theatres for any present or future dates, accommodates emergency operation, generates preoperation checklists including instrument lists and personnel assignment sheets.
- Pharmacy Management Application; this caters for drug information, prescription and dispensing functions of the pharmacy department. It maintains complete drug formulary with contra-indications, dosage details, etc. and supports various drug classifications and indexes.
- Pharmacy Stock Application; this is closely integrated with the Pharmacy Management module in streamlining and controlling the inventory of items pertaining to the pharmacy. How to identify items and stores, move items from one store to another by request it and issue the request, control store transaction and how to work, and setup the users for each store.
- Radiology Application; this supports patient registration, resource scheduling, request registration with examination details, reporting, post-examination registration, billing, film tracking and management information.
- Laboratory Application supports patient's specimen registration and verification, tests resulting, result releasing, and results reviewing. Many types of result types are supported such as numeric result, textual report, organism sensitivity to group of antibiotics, and result comments. Also the system is interfaced to patient billing. Finally the system is capable to communicate with different models of Analyzers such that specimen requests are uploaded to analyzer and result is downloaded from analyzer automatically

# D. Instrument

A new questionnaire developed for the purposes of this study was used. The questionnaire is comprised of 38 main psychometric questions to identify and measure physician's use, knowledge, and perceptions regarding the use of the HIS. The questionnaire was developed in light of research objectives and literature review. It included items to identify physicians' age, specialty, years of practice and years of practice at study hospital. The application of the questionnaire had shown a satisfactory reliability coefficient Cronbach Alpha of 0.80.

#### E. Data Collection

A small-scale pilot test was conducted to ensure clarity of the questionnaire. Questionnaires were distributed to 50 staff physicians. Twenty nine of them responded to the questionnaire with a response rate of 58%.

#### F. Data Analysis

Data was initially entered using Microsoft Excel and then imported into and analyzed using the Statistical Package for Social Sciences, version 11 (SPSS). Frequencies of the 38 psychometric questions were conducted and percentages calculated. Means and standard deviation were calculated for age and years of experience.

#### III. RESULTS

#### A. Sample

The average age of respondents was 46 years with a standard deviation of 8.8. Respondents' average years in medical practice were 20.3 years with a standard deviation of 9. Respondents' average years of practice in the hospital where the study was conducted was 3.7 years with a standard deviation of 0.57. Respondents were from almost all medical specialties practicing in the hospital.

### B. Use of Computers

The findings of the study show that staff physicians enjoy using computers. In fact seventy two percent (72%) of the respondents reported that they enjoy using computers in general.

#### C. Use of the HIS

Although fifty two of respondents reported that they think the system is not easy to use, seventy two percent (72%) of them reported that they use it on a daily basis. A slight majority (52%) reported that they like to use the system.

#### D. Physicians' Knowledge about the System

The questionnaire included three items that test respondents' knowledge about certain features of the HIS. The results show that physicians are not completely aware of all features of the system. The study found that seventy six percent (76%) of respondents reported that they are aware of "Patient Drug Profile" feature of the system. On the other hand, eighty six percent (86%) and fifty nine percent (59%) of the physicians reported that they are not aware of the "Patient's Allergy Profile" feature and "Vital Signs" feature, respectively.

### E. Access to Information

Results show that seventy six percent of the physicians (76%) reported that the system had improved access to patients' medical information; ninety percent (90%) reported that the system had improved the speed of access to patients' laboratory results; eighty three percent (83%) reported that the system had improved the timeliness of access to patient information; fifty nine percent (59%) reported that the system had made accessing patient demographic information easier than before. Only forty five percent (45%) of respondents reported that the system had improved the speed of access to radiology results.

### F. Security and Privacy of Information

Larger percentages (48% vs. 41%) of the physicians believe that the system did not help in protecting the confidentiality of private patient information. Additionally, fifty one percent (51%) of the physicians believe that the system allows for easy access to patient information to unauthorized individuals.

#### G. Communication Effectiveness

Findings show that sixty two percent (62%) of the physicians reported that the system had improved communication effectiveness. Additionally, seventy six percent (76%) of them reported that the system improved communication effectiveness between physicians and the laboratory. Despite the general perception that communication effectiveness was improved, only 39%, 38%, and 27% of respondents reported that the system had improved their communication effectiveness with nurses, radiology, and other physicians, respectively.

#### H. Quality of Services

About half (48%) of the physicians reported that the system had helped in improving the quality of services. Eighty six (86%) and fifty two (52%) percent of the physicians reported that the system had improved the accuracy of laboratory results and patient information, respectively. Fifty percent (50%) of them reported that the system had made medical decision making more based on information. On the other side, eighty percent of respondents reported the system did not help in making administrative hospital procedures simpler and seventy nine percent (79%) reported that the system did not help in reducing the time patients take to complete administrative hospital procedures.

# I. Efficiency

Findings show that seventy two percent (72%) of the physicians reported that the system helped in preventing the provision of unauthorized free health care as a result of

nepotism (WASTA). Sixty one percent (61%) of the physicians reported that the system did not influence or alter their productivity levels. Seventy nine percent (79%) and fifty five (55%) of the physicians did not agree that the HIS helped in reducing the consumption of material resources or the cost of providing health services, respectively. It was obvious that physicians had difficulty deciding whether the system had helped in reducing the cost of services or not (38% of them chose "I don't know" answer to this question.

#### J. Human Resource Performance

Forty one percent (41%) of the physicians reported that the system had improved job performance of hospital employees. On the other hand, an equal number did not agree with this finding. Fifty five (55%) of the physician did not agree with statement indicating that the system had helped in improving their job performance. Additionally, fifty nine percent (59%) of the physicians reported that the system did not help in clarifying employees' responsibilities.

#### IV. CONCLUSION AND RECOMMENDATIONS

There is a belief that physicians are resistant to the idea of information systems and use of computers in general [8]. The results of this study contradict this misconception and show that staff physicians enjoy using computers and are using the HIS on a daily basis.

The study reveals an interesting and significant culturallyspecific finding, that is, the perceived influence of the HIS in preventing the provision of unauthorized free health services as a result of nepotism (Al Wasta). This finding has great potential of such systems in changing negative cultural practices and attitudes.

The results show that physicians are not completely aware of all features of the HIS. This fact hinders full realization of system objectives. These results illustrate the need to develop a comprehensive training plan that takes into consideration that training is a continuous process adapted to the specific needs and circumstances of trainees. Additionally, the shortage of IT staff during initial phases of system implementation may lead to these results.

A notable finding of this study is the ability of the HIS in achieving its intended objectives related to the laboratory application. Specifically, speed of access, accuracy of results, and effectiveness of communication. These findings indicate a case of "best practice" that needs to be studied and analyzed for lessons to be inferred and applied in other similar situations.

In general, study findings indicate that the HIS was in general effective in improving access to information. Still there seems to be a problem in protecting information confidentiality and security. This issue requires further study and analysis to find the causes of this phenomenon and identify solutions. More stringent information security policies and procedures is one suggestion to pursue. The results indicate that the HIS was moderately effective in improving communication effectiveness. This find conforms to the fact that the system does not include an application for transferring messages between individual providers or between groups of providers. It is recommended to implement such application for enhancing communication between all involved providers of care.

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