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Adoption of Health Information Systems in Sri Lanka

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Abstract: *Innovations in the use of emerging Information and Communication Technology (ICT) have rapidly increased in all development contexts, including healthcare. Today, with the advancement of technology, most people buy their air tickets and check in to flights online, purchase goods on the Web, and even earn degrees online. In an era where most commercial transactions are partially or completely automated for reasons of efficiency and accuracy, it is somewhat ironic that most recording of medical events are still done on paper. Having a Health Information System (HIS) in the clinical setting reduces the workload of the hospital staff in maintaining clinical and administrative records specific to a patient. An automated system as such with all necessary data fed in it is likely to reduce the workload of the clinicians put in filling the forms, rewriting the prescriptions, searching for old records of patients and generating summaries of all laboratory test results. Similarly, deployment of HIS makes the hospital administration easy by providing evidence for financial audits, order entry and drugs and supply management. Although, the complete HIS does not currently exist in Sri Lanka, portions of the hospital administration and patient administration processes are being computerized. The private hospitals in the major cities of Sri Lanka, lead their way in computerization of recordsrelated to administration and finance. Proponents of such systems report that many of these implementations are successful, and that their services have improved tremendously after the adoption of HIS. However, there has been little interest in leveraging the success of HIS in Sri Lanka. Most hospitals still rely on paper-based systems. This research focuses on understanding the low penetration of ICT among clinicians in Sri Lanka and the potential barriers in adopting HIS at their hospitals.*

Keywords: *Health Information Systems, Healthcare, Adoption of Technology, Clinicians, Patients, Electronic Medical Records*

1. Introduction

Sri Lanka has an extensive network of healthcare institutions. Its healthcare system is a combination of public and private sector. The public health system is completely financed, staffed, equipped and run by the Government through the general revenue sources. On the other hand, the private sector which provides similar services is financed through fees levied for services that are offered to the patients. However, there is no registered population for any particular healthcare institution. In this unique healthcare system, one can go directly to the private or government hospital to see a general physician or a specialist with no reference from a third party. Patients are free to select the doctor to consult and the hospital to which they prefer to get admitted to. This free movement of patients within and between different levels of care has given rise to a situation where each patient–doctor encounter needs to be mandatorily recorded and managed by different doctors of differing specialties.

The major problem with the prevailing system is that the medical record of a patient is recorded on paper and it could be misplaced and fragmented across the physicians' offices. The records are often disorganized due to the fact that pages are added to the existing records as they are generated chronologically. Overtime, this makes the follow up procedure very complex as it is difficult to view summarized data. This situation leads to a gap in communication between multiple caregivers leading to poor coordination in delivering healthcare services.

The result is that the patient does not receive best service that is available and due to him. This situation needs to be addressed so that a patient could have the privilege of getting uninterrupted and the best care provided at any healthcare organization he/she prefers to be served at.

It is accurate and much faster to collect, store and process data, and retrieve information when computers are in place. Deployment of HIS in the hospitals helps to overcome the problems faced in the current context. With an automated system in place, a hospital could easily be administered: 1)the appointment is fixed and the token is issued through a web portal, 2)the test results of a patient is aggregated and presented to the clinician on a timely manner, 3)the medical records of patients are stored in digital form making it easy to edit, search, summarize and exchange, 4)monitor the supply of drugs in the pharmacy and notify the relevant pharmaceutical company or distributor and 5)manage the records related to financial transactionsbetween the organization and staff, patients, partner organizations and government [1].

Yet, despite these benefits, the hospitals in Sri Lanka still rely on paper based systems where patients are given handwritten prescriptions and asked to maintain personal files with all test results and prescriptions to aid the continued medical care.

2. Background

The major revolution in Information Management is the widespread use of computers. Having a computerized system with all necessary information fed in it shall reduce the workload of the clinicians put in filling the forms, rewriting the prescriptions and searching for old records [1]. Health Information System (HIS) is an integrated effort to capture, store, process, report, exchange and use health information of individuals or the activities of the organizations that work within the health sector for clinical decision making, policy making, program action and research. Therefore, the HIS can be seen as a collection of individual systems such as: Patient Administration System (PAS), Laboratory Information Management System (LIMS), Electronic Medical Records (EMR), Electronic Health Records (EHR) and Management Information System (MIS)[2].

PAS is the basic component of a HIS that records patient details on admission, discharge, ward allocation, transfer, treating clinicians and the attendance of outpatients. While, LIMS requires interaction with all laboratory machines that capture data electronically. With the use of LIMS, all samples and test results will be provided to the physicians in a timely manner.EMR is a digital version of the patient's record maintained in the clinician's office. An EMR contains patient's demographics together with the clinical data such as: medical history, diagnoses, prescribed medication, treatment plan, test results, progress notes, vital signs, immunization dates, allergies, radiology images, and laboratory and test results, all in electronic form.Maintenance of records in digital format allows tracking data easily over time while allowing the records to be shared across different departments or healthcare institutions involving healthcare professionals at all levels – specialists, clinicians, nurses, laboratory technicians, medical imaging technicians, pharmacists and paramedics.EHR is a longitudinal electronic record of patient health information maintained by the provider over time in one or more encounters in any care delivery setting. EHR is a real time, patient-cantered records that make information available instantly and securely to authorized users. MIS brings together all information that is needed to administer the health system. Ideally this includes information on daily activities, human resources, finance and supply management [2].

Implementation of HIS in hospital environment has its benefits; it improves the quality of service by enabling the clinicians and other providers access the medical information about their patients on a click of button so that they shall have complete understanding of the condition of the patient before coming up with a treatment plan. In addition, the removal of paper from the system also results in administrative cost saving and improve efficiency [3].The medical expenses of a patient is reduced by eliminating the duplicate or repetitive clinical laboratory tests. The HIS is beneficial especially when handling emergency or disaster situations. In a situation where a patient needs emergency care, the HIS becomes handy by providing quick access to the medical records to the doctors involved to provide emergency services.

3. Related Work

Previous researches in this domain have claimed wide spectrums of potential barriers that may obstruct the adoption of computers in clinical practice. Johnson's study was to review the literature to better elucidate barriers that are likely to affect the adoption of ICT by paediatric professionals. His findings indicate that a variety of factors affect the adoption of useful technologies: situational barriers include challenges imposed by the current health environment, financial and legal risks associated with technology purchasing and use, and access to technology are the factors concentrated in his study. The most significant barrier is that paediatric health care practitioners lack the knowledge or training to use technology effectively [4]. Treister analysed how well new medical Information Systems are accepted by the physicians. The study indicated that the physicians often fail to embrace a complex Information System as they do not see its relevance to their practices and are characteristically reluctant to invest the time and energy to be trained in its use[5].Another research on Nursing Information System (NIS) reveals that lack of a unified nursing language and individual and organizational factors such as characteristics of the nurses, the unit, the administrative philosophy, and workload issues are the barriers to NIS development. The Increased nurse involvement, education and recognition of the benefits of computerization are suggested to overcome the barriers [6].

A study has been carried out in Hong Kong among the physicians to understand their attitudes towards the use of computers in the clinical setting. A self-completed, 20-question postal questionnaire was sent to 4850 randomly selected physicians. The questionnaire focused on details of the physicians' practice, actual computerization, intention to computerize clinical and administrative functions, attitudes towards computerization, self-perceived computer ability and knowledge and demographic information. 897 responses were received indicating strong support for the attitude statements with regard to the benefit of computerization to patient care. However, there was less support for maintaining medical records electronically. The physicians were concerned about the negative impact of computerization on the clinical encounter and the perceived high cost of computerization [7]. Given the slow adoption of medical informatics in Hong Kong and Asia, a study was conducted to understand the contributory barriers and potential incentives associated with information technology implementation. A representative sample of 949 doctors was included in a postal survey to rank a list of nine barriers associated with clinical computerization according to self-perceived importance. The study provided evidence that time, costs, lack of technical support and large capital investments were the biggest barriers to computerization, whereas improved office efficiency and better-quality care were ranked highest as potential incentives to computerize hospital processes [8]. The findings help the researchers identify possible incentive strategies that may be employed to accelerate uptake of computer systems by the clinicians.

4. Theory

User acceptance of technology has been an important field of study for over two decades now. Although many models have been proposed to explain and predict the use of an Information System, the Technology Acceptance Model (TAM)proposed by Fred Davis has been the only one which has captured the most attention of the Information System Community. He proposed that the system use is a response that can be explained or predicted by user motivation. It is suggested that users' motivation can be explained by three key factors: perceived ease of use, perceived usefulness and attitude towards using the system. The attitude of a user towards a system was a major determinant of whether or not the user will actually use the system. The attitude of the user was considered to be influenced by two major beliefs: perceived usefulness and perceived ease of use, with perceived ease of use having a direct influence on perceived usefulness[9].

TAM evolved into a leading model in explaining and predicting system use. In fact, TAM has become popular that it has been cited in most of the research that deals with user acceptance of Technology [10]. Prior to the work of Davis, several studies had highlighted the importance of perceived ease of use and perceived usefulness in predicting a person's behaviour.

In 1979, Robey confirmed that the high correlation existed between perceived usefulness and system usage [11]. While, Bandura showed the importance of considering both perceived ease of use and perceived usefulness in predicting behaviour[12]. Similarly, Swanson's research provided evidence that perceived ease of use and perceived usefulness were both important behavioural determinants [13].

5. Methodology

The research aimed to capture the causes for low penetration of ICT and the potential barriers in adopting HIS in the healthcare settings of Sri Lanka. Emphasis was placed on the clinicians to know why they do not show interest in embracing new technology that would save their time and reduce their workload. The research involves a cross sectional time horizon and uses simple random sampling technique to pick the respondents.

- **Subject Recruitment:**

Details of all private hospitals situated within the Colombo city limits were retrieved. It was analysed whether or not those hospitals had a computerised system that is closely related to at least one of the individual systems that is explained in section 2. As the result, only 15 hospitals were selected. 15 clinicians from each hospital and of differing speciality were randomly selected for data collection, making the sample size as 225. Only the respondents who had worked for a period of six months in the respective hospitals were included in the study to ensure that they know the administrative procedure that is followed in the hospital and are aware of the technology solutions that existin their workplace. The respondents were carefully selected so that they represent the population of clinicians who are willing or unwilling to use the HIS.

- **Comprehensive Literature Review:**

Sri Lanka Journal of Bio-Medical Informatics, Journal of the American Medical Informatics Association, British Medical Journal, and International Journal of Medical Informatics are the journals that were referred. Medline, PubMed and Science Direct were the databases accessed to obtain the search results. Also, the organizational websites of World Health Organization, Ministry of Health - Sri Lanka, Ministry of Health – Singapore were accessed.Articles discussing barriers or factors affecting the adoption of ICT in hospital environments were considered for inclusion while articles not related to clinical IT or HIS were simply excluded. The search was limited to the contents in English.

- **Data Collection:**

Questions were constructed after reviewing similar reports in the literature. In particular, the study was underpinned to TAM. The primary data was collected using questionnaire that contained 17 self administered questions, divided into 3 sections. The respondents were asked to provide rank for the factors that they believe is a barrier to use HIS. No ties were allowed. The respondents who were unaware of the existence of HIS in any hospital environment they are attached to and the questionnaires that returned without being answered were excluded from the study. This allows the research to achieve an overall response rate of 90%. The data was cleaned and analysed using SPSS.

6. Findings and Discussion

Out of 203 independent respondents only 40 clinicians showed liking to use such automated system. They believed that the system will be easy as the interface will have all the required fields to be filled by selecting an option form the drop down list or by putting ticks on the option boxes. They preferred the computer application that has fewer contents to be written or typed. The large population was not willing to adopt the HIS due to various reasons. The following are the top five reasons stated by the clinician as to why they do not prefer to adopt HIS into their practice:

- **Lack of Skills**

Although, 182 respondents indicated the use ofcommon computers applications such as emails, internet browsers and word processing, approximately 80% of the clinicians reported that they do not wish to

communicate with their patients via e-mails. For many participants, the use of a computer in the work environment was a completely new experience. Approximately 47% of respondents indicate the inability to type fast on a keyboard even though they are familiar with the usage of computers. Speed of typing becomes a barrier when the data needs to be recorded to the system while the patients are examined.

- **Time Consumption**

Time emerged as an underlying barrier. Slightly more than a half of the clinicians indicate that using an HIS in clinics is time consuming. The arguments were strengthened by indicating the factors such as: time taken to enter data to the system, time taken to learn the system and time spent on consulting a patient. A common complaint was that a clinician has to spend more than the time which is usually spent with a patient. And, it is not due to the examination or developing a treatment plan but recording the medical information to the computer. The amount of time required to record patients' informationin the HIS was not appreciated.

Adopting to the new system is likely to take more time as the clinicians are working based on shifts and use the system not more than 3-6 hours per week in a particular hospital. They indicated that there was not enough time available to learn how to use the HIS in real time.

- **Complexity of the HIS**

The system is considered to be complex as they do not know how to start up the application, where to click, what fields are mandatory to fill, how to search for a record and where to navigate. At the same time, learning to use a new system is a burden as most clinicians in this study work for more than one healthcare institution. In that case, each hospital will have systems from different vendors where the functionalities and the appearance of the interfaces are different from one hospital to the other.

- **Technical Issues**

Another important factor that was reported is the operational failure that could occur in computerised system due to power interruption, system malfunction, etc. Respondents were concerned that the unavailability of the system could cause loss of data. Also, it is preferred to have technical assistance available throughout the day if an automated system is in place. The respondents preferred to have in-house problem solvers who will be available to support the colleagues on an ongoing basis especially to provide assistance when problems arise.

- **Interference with Communication**

Clinicians do find that the existence of a computer in their clinic to record the clinical information is interference with the doctor-patient communication. Having a computer located on the clinician's desk and recording the complaints of the patients does not allow the clinician to make eye contact with the patient. This situation is likely to raise trust issues in the patients about the service the doctor is going to provide.

The clinicians clearly stated that more than improving the efficiency of the hospital administration, they would like their patient-doctor time to remain traditional to help gain the patients' satisfaction.

- **Resistance to Change**

The introduction of new technology into the current working system means that there is a change in the ways howtasks are usually done. Staff are required to have new skills, will be asked to play new roles and this may require organizational restructure. Most clinicians are resistant to such changes as they are threatened by the roles and responsibilities they will have to take up in future.

7. Conclusion

The study was conducted on a representative sample of clinicians who work at popular private hospitals situated in Colombo city limits to understand the low penetration of ICT among the local medical practices and to identify the potential barriers doctors encounter in adopting HIS to their workplace. This study provided evidence of the common barriers associated with clinical computerization. Examples includelack of skills possessed by the clinician in using technology or computer applications in workplace, consumption of time,

complexity of the system, technical issues that could arise while working with the system and attitudinal or behavioural issues. It is to be noted that very few, less than 20% of respondents were aware of the medico-legal or liability concerns.

The most important disincentive to adopt HIS is due to the time taken to learn the system and the complexity of the system. Both factors combined with lower level of basic computing skills make the clinicians resistant to adopt the HIS in place. Another common complaint is the potential for interference with the patient-doctor encounter. Turning the disincentives into opportunity for change remains the challenge. Although some barriers that exist may be challenging to overcome, other barriers, such as the lack of skills in using technology, are imminently solvable. Efforts to overcome these barriers should begin in earnest and should include educating clinicians in the care of patients.

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