

Clinical Information Systems in Private Hospitals

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Abstract— With the tremendous developments in Information Technology (IT), many organizations in private sectors use IT to transform their services and operation. Like any other sectors, the health sector has been benefited from the adoption of IT in transforming their services for society well-being. The applications of IT have greatly improved accessibility, quality and cost-effectiveness of healthcare. Clinical Information Systems (CIS) are one of the examples of the applications of IT in healthcare. CIS are computer applications that support the operations of clinicians engaged in providing care to patients. However, CIS does not always improve the outcomes and performance of the health professionals, but might bring about negative impacts on their performance and practices. Studies on medical errors have shown that errors in healthcare and medicine are not rare and may bring about severe harm to patients. This paper aims to understand the use of CIS in hospitals and their impact on patient safety. Using interviews with medical practitioners in private hospitals in Malaysia, the findings provide insights for system developers and hospital managers on the usability of CIS to ensure the delivery of better patient care since error reduction is one of the dimensions of health service quality.

Keywords— Clinical Information System, System Quality, Information Quality, Hospitals

I. INTRODUCTION

A clinical Information system (CIS) is a tool used to coordinate health services. CIS, according to [1] refers to skills, knowledge and tools used to collect, manage, use and share of information required to improve the delivery of healthcare services to individuals. The main purposes of CIS are to improve efficiency in healthcare, to ensure evidence-based medicine, to increase quality of care, to empower patients, as well as development of closer and better relationships between healthcare professionals and patients. A clinical information system includes a variety of components, but the primary components of any CIS are electronic health records (also known as electronic patient records), computerized patient (physician) order entry (CPOE) system, and computerized decision support systems (CDSS). Today, hospitals have employed advanced ICT to improve and enhance their efficiencies and facilitate their operations but little is known to what extent the system have improved and enhanced the efficiencies.

Such transformational services in hospitals through the adoption of information and communication technology

improve society well-being could enhance health service quality [2], effectiveness and efficiency of personnel and also reduce operational costs [3] (Aggelidis and Chatzoglou, 2008). The use of effective and efficient information system in health organizations could also reduce medical error and improve patient safety ([4]; [5]) Eslami et al., 2008; Chiasson et al., 2007). The claimed and expected positive impacts and benefits of CIS have convinced many hospitals and clinics to implement clinical information systems [5] (Chiasson et al., 2007). However, the benefits and positive impacts of CIS have not been fully proven [6] (Yusof et al., 2008). It has been stated that the level of technological sophistication in a hospital does not necessarily guarantee the desired clinical outcomes because though the technology is implemented and available to users, it may not be used to its full capacity and therefore, it may not produce the desirable clinical impacts [7] (Jaana et al., 2005). Hence, it is needed to assess CIS to find the extent of which it leads to positive outcomes in healthcare.

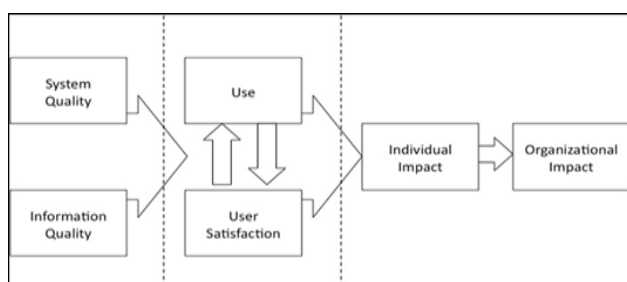
This paper aims to understand the use of CIS in hospitals and its impacts on the reduction of medical errors and improvement of patient safety. This paper addresses specific questions; (1) to what extent does CIS being used by medical practitioners and other users in hospitals? and (2) what are the impact of CIS in reducing medical errors and improving patient safety in hospitals? Using private hospitals in Malaysia, this paper hope to provide preliminary understanding on the use of CIS and its impacts on individuals and organizations.

This paper proceeds as follows: next section present the research context and conceptual framework of the study. Later is the methodology section and findings analysis. This paper ends with the discussion on findings, contributions and conclusion.

II. CONCEPTUAL FRAMEWORK

Information System (IS) success and failure has become an important issue that many researchers try to explore since the introduction of the Internet and all other computer and technological advancement. This paper will use DeLone and McLean model [8] as theoretical framework, which is found useful in explaining the success or failures of IS [9]. DeLone and McLean model is based on Mason's [10] study which was developed from Shannon and Weaver's Communication Theory [11].

DeLone and McLean used Mason's Framework to propose six dimension to measure the IS success (Figure 1). There are system quality, information quality, system use, user satisfaction, individual impact and organizational impact. System quality refers to the functionality and efficiency of system. Information quality is related to the ability of the system to provide precise, up-to-date, sufficient and relevant information. Use or usability refers to the capability of the system to be easily understood, learned, used and convenient. User satisfaction focuses on process and should be seen as a signal of acceptance of users rather than a measure of organizational outcomes. Individual impact refers to the change of receiver behavior because of the information provided by the system. Organizational impact is related to the improvement of products, services or management.



Source: DeLone and McLean (1992)

Figure 1. Suggested Conceptual Framework

III. METHODOLOGY

This study used a qualitative method incorporating open ended interviews. The study includes three private hospitals in Malaysia. The name of hospital is disguised for confidentiality as insisted by interviewers. They are named as Hospital X, Y and Z. The hospitals use in-house system as well as a system purchased from a vendor.

Hospital X uses simple in-house CIS. The CIS provides information that should help medical practitioners to diagnose, assess and choose the right medication for their patient. The system collects data but do not provide access to the users to go through the data. They can follow up and trace by date within the years. Hospital Y uses both in-house CIS and off-shelf CIS which covers registration, appointment, admissions, and discharge and transfer module. The system also provides information on the type of medication and operation appointment date.

Hospital Z uses off-shelf software that provides information on patient registration and discharge, medical history of patient, order of medicine from pharmacy. The interviews were held with medical practitioners, pharmacists, staff nurse and information technology staffs from November 2011 to May 2012. The interviews include views on CIS in relation to system quality, information quality and impacts on individual

and organization [8]. Details of interviews are presented in Table 1.

TABLE 1. INTERVIEW DETAILS

Hospital	Name & Position	Hours of Interview
Hospital X	Medical Practitioner 1	1
	Medical Practitioner 2	1
	Medical Practitioner 3	1
	Medical Practitioner 4	1
Hospital Y	Head of Pharmacy	1
	System Support	1
Hospital Z	System Analyst	1
	System Security	1
	Staff Nurse	1
Total Hours		9

The study employed open and pattern coding to analyze the interview transcripts. Prior to data analysis process, the interview data was transcribed, later read, sorted, edited and checked for the transcript accuracy. Later the researcher read, reflected, categorized and coded each text within every note and transcript according to meaning that the text brought into the reconstruction of the phenomenon. Based on the research objective, the study firstly developed open codes for the text, which categorized the texts into their broad topic. Secondly, the researcher compared, contrasted, interpreted, reflected, and gave meaning to the text to come out with their descriptive text as to represent the meaning of the texts. The transcribed interviews were thematically analyzed and explained using [8]

IV. FINDINGS AND ANALYSIS

A. Usability - System & Information Quality

Findings show that the three private hospitals used CIS for making appointments, documentation, medical and patient information. Medical practitioners feel that the CIS are useful in reducing medical errors and improving patient safety as it provides information about the patient and help them to diagnose the patient according to the medical history. Medical Practitioners from Hospital X explain:

"We have here the diagnosis systemic, by which we follow the sequence of history; examination and diagnosis. If I do not fill up the form in the system when diagnosing the patient, the system will not order medicine. In other words, you cannot give medicine to your patient. The diagnosis system accumulates information every months, e.g. how many patient comes with skin problem or how many patients come with eye disease. The system will also alarm you if you give wrong medication. Medical Practitioner 2, Hospital X"

"CIS could minimize errors in prescriptions because sometimes the doctors cannot remember all the medicine. By using the system, the doctor can select the best medicines for the patient." Medical Practitioner 3, Hospital X"

In addition, the CIS also makes the job of ordering medicines from pharmacy more efficient as the information of the type of medicines assigned to a patient can be sent directly to the pharmacy. Such process could reduce medical errors. Medical Practitioner 2 from Hospital X explains:

“When I click the medicine order here, the system will send directly to the pharmacy and the pharmacist could easily assess and calculate the number of tablets required daily and its expiry date, thus prevent them from making mistakes like dosage mistake. The system also provides information on the available stock in pharmacy. For example, if the colour is blue, it shows that the medicine is not available. I can check through the system which medicine is available and I can choose the suitable one. Medical Practitioner 2, Hospital X

Despite that, the Head of Pharmacy in Hospital X explain that they still could not avoid human errors especially during registration and the staff at the registration counter may have mistakenly key in wrong patient and doctor number which may lead to patient being diagnosed differently. In terms of system quality, they are looking for a simple and user friendly system. If possible they would like to have all of the information about patient in one page. The Head of Pharmacy of Hospital X explains:

“The system should be as simple as possible and user friendly. Everything should be available in one page, which means the patient name and serial number, the diagnosis, clinical notes, and medicine are in one page so that we do not have to click another page. For example, if the patient number is 3005, we must check whether he is the right patient. For patient safety, we don’t want to give wrong medicine to the patient.” Head of Pharmacy, Hospital X.

B. Individual and Organizational Impacts

Findings show that the impact of CIS on individual and organizational are related to decision making, particularly on diagnostic and treatment decisions. The CIS improve the process of documenting medical information, which could improve the reliability and accessibility of medical data. In addition to that, CIS allow doctors or users to reassess information and produce the required report for medication purposes. As indicated by several interviewees:

“They can do a kind of a research review and can get additional data, so they can give a kind of preventive measure to the society. In medical world, there are two parts: one is clinical part, the other one is public health. Until now, as far as I know, the clinical doctors do not think that doing research or reassessment review is their work because they don’t have enough time to work on them. But the public health people usually like to have this. Using CIS, the research and reassessment work make it easier.”

“I am involved with especially doctors, physicians and clinicians, and I found that CIS can make their work more efficient and systematic especially in producing reports and statistics. They can also retrieve data if the doctor misses the report, because we have repository center or database.” System Support Officer, Hospital Z

According to Staff Nurse in Hospital Z, doctors can trace all notes about patient’s background and history. Doctors can diagnose the patients by referring to the information in the system. They can easily modify notes, make orders, view results, cancel or delete information in the system. Doctors can give treatment and make decision immediately because most of the information required is available online, hence could improve patient life safety. For example, when the patient needs to have blood test, doctor can order from the system. When the sample or the blood patients were sent to the lab and after the test is completed from the lab, the doctor can view the result from the system immediately. From the results and investigations, the doctor can diagnose patients for the further treatment.

V. CONTRIBUTIONS AND CONCLUSIONS

In short, findings show that although CIS has been used in private hospitals in Malaysia, the usage is not comprehensive. Most of the hospitals are using simple CIS, but still have impacts on medical errors reduction and patient safety improvement in hospitals.

Theoretically, this study provides empirical evidence on the impact of CIS on the transformative services in hospitals particularly in Malaysia. Some scholars have called for more research on the impacts of IS in developing countries due to the availability of numerous research in the developed countries [12] (Peikari, 2010). It was found that CIS impacts are different in different countries [7] (Jaana et al., 2005), which justifies a context-based investigation of CIS in different countries.

Practically, this study has specific impacts on health professionals’ practices and outcomes as it provides insights to system developers and hospital managers in order to ensure better transformational services for society well-being through the delivery of better patient care. Furthermore, the evaluation of CIS is vital to promote the national agenda for clinical information systems and the transformational of health service in Malaysia. Third party organizations such as insurance companies, local and federal governments have always been interested to know whether hospitals can provide good quality healthcare services to patients or not. The findings will provide insights for third party organizations on this regards and will assist them to evaluate the current scenario and formulate new policies and strategies to ultimately improve patient safety and health service quality in hospitals.

Nevertheless, this study is still limited to several interviews that contribute to preliminary understandings of CIS implemented in private hospitals. Future studies may need to focus on public hospitals and CIS impact on the transformation of health services for society well-being.

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REFERENCES

- [1] Park, J., McAlaney, C. and Connolly, M. (2008), Improving patient care and clinical governance through the utilisation of a clinical information system, *Clinical Governance: An International Journal*, Vol. 13 No. 4, pp. 254-260.
- [2] McNeely, M.D. (2006), Computer-assisted laboratory test ordering and interpretation, *Lab Medicine*, Vol. 37 No. 10, pp. 623-5.
- [3] Aggelidis, V.P., and Chatzoglou, P.D. (2008), Methods for evaluating hospital information systems: a literature review, *EuroMed Journal of Business*, Vol. 3, No. 1, pp. 99-118
- [4] Eslami, S., de Keizer, N.F., Abu-Hanna, A. (2008), The impact of computerized physician medication order entry in hospitalized patients - A systematic review, *International journal of medical informatics*, Vol. 77, pp. 365–376.
- [5] Chiasson, M., Reddy, M., Kaplan, B. and Davidson, E. (2007), Expanding multi-disciplinary approaches to healthcare information technologies: What does information systems offer medical informatics?, *international journal of medical informatics*, Vol. 76, pp. S89–S97.
- [6] Yusof, M.M., Kuljis, J., Papazafeiropoulou, A., & Stergioulas, L.K. (2008). An evaluation framework for Health Information Systems: human, organization and technology-fit factors (HOT-fit). *International Journal of Medical Informatics*, 77, 386–398
- [7] Jaana, M., Ward, M.M., Par'e, G. and Wakefield, D.S. (2005), Clinical information technology in hospitals: A comparison between the state of Iowa and two provinces in Canada, *International Journal of Medical Informatics*, Vol. 74, pp. 719 - 731.
- [8] DeLone, W.H. and McLean, E.R. (2003), 'The DeLone and McLean model of information systems success: A ten-year update', *Journal of Management Information Systems*, vol. 19 no. 4, pp. 9-30.
- [9] Petter, S., DeLone, W. and McLean, E. (2008), 'Measuring information systems success: models, dimensions, measures, and interrelationships', *European Journal of Information Systems*, vol. 17, pp. 236-263.
- [10] Mason, R. (1978), 'Measuring information output: A communication systems approach', *Information & Management*, vol. 1 no. 5, pp. 219-234.
- [11] Shannon, C. and Weaver, W. (1949), *The mathematical theory of communication*, University of Illinois Press, Urbana, IL.
- [12] Peikari, H.R., (2010), Does nationality matter in the B2C environment? Results from a two nation study, *Communications in Computer and Information Science*, 92: 149-159.