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THE CHALLENGES OF HUMAN FACTORS FOR IMPLEMENTATION OF INFORMATION SYSTEMS IN THE HEALTHCARE

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ABSTRACT

Healthcare Information Systems (HIS) play an important roles in helping to coordinate activities across units within hospitals through fast access to patients' electronic records. HIS is an initiative taken by Malaysian government to resolve several issues such as increasing number of patients who are in needs of treatment, increasing waiting time for receiving medication etc. HIS adoption is increasing globally, including Malaysia. Malaysia begin to adopt HIS in 1999 which covers both clinical and non-clinical information system. Since its introduction, hospitals are facing with various challenges to achieve objective of its adoption. Understanding factors that detain the success of HIS implementation is a central concern of Healthcare Informatics. Among others, human factors or HIS users (medical practitioners) is one of the issues that important to be considered as they play a significant role in influencing the HIS adoption in hospitals. Human factors are essential in identifying human constraint and needs when interacting with the system for improving work effectiveness and productivity. Any issue encounters by medical practitioners need to be identified earlier to avoid failure of use once the system is launched. Failure of interaction effectively between human and technology might lead to medical errors. Thus, the aim of this study is to provide a review of challenges associated with human factor through the adoption of information system in hospital and to suggest strategies to tackle or minimize issues associated with human factors. Based on the term "Hospital Information System", "Electronic Health Record", and "human factor", articles were retrieved from electronic journal databases using a systematic search techniques. Some inclusive and exclusive criteria such as year of publication, writing language etc. were applied. Based on study, there are constraints on human factors with the adoption of information system in hospital. This paper provides view on human-related issues that are important to be addressed in the implementation of information system.

Keywords: health information system, human factors, medical practitioners, challenges/issues/problems.

INTRODUCTION

Healthcare Information System (HIS) has been introduced more than 50 years ago where the system is designed to facilitate medical services, especially in providing fast treatment to patients in speeding daily tasks which could reduce registration waiting time. HIS is designed to reduce the time allocated to each patient during medical consultation and aimed to improve the quality of healthcare services, especially enhancing patient satisfaction and improved patient record management [1].

HIS in Malaysia

Ministry of Health Malaysia, take the initiative improving medical service with the implementation of Hospital Information Systems (HIS). Abdul Hamid clarified that HIS was planned in 1993 under the 6th Malaysian Plan. Following this, on 1st August 1996 Telehealth project was launched [2]. Telehealth targeted to provide seamless health information and virtual health services to all Malaysian through integration of information technology, telecommunication, human-machine interface technologies and health technologies [3].

Three types of Information systems are being used in Malaysian public hospitals; Basic Hospital Information System (BHIS), Intermediate Hospital Information System (IHIS) and Total Information System (THIS), which are determined by the hospital size and number of beds available in every hospital [4, 5]. Each type of HIS has different information system components based on the hospitals' usage, department and others. THIS is a paperless hospital which has complete HIS components meanwhile BHIS and IHIS maintaining both electronic and manual systems and important component based on the hospital requirements.

Hospital Selayang was the first hospital in Malaysia to operate THIS in 1999 [6]. Hospital Selayang was uniquely designed to implement IS to improve service delivery by focusing on the patient and management system in order to maximize the efficiency and utilization of their staff. Hospital Selayang was only opened to public after thorough testing was done by medical and non-medical personnel for a period of 2 years [7]. In year 2000, Hospital Putrajaya integrated information systems into medication administration and documentation. In year 2008 Hospital Universiti Kebangsaan Malaysia (HUKM) developed in-house patient monitoring system for inpatients [5].

BACKGROUND AND RELATED WORK

Many hospitals face various challenges through the introduction of HIS [8]. For new hospital, implementation of HIS seen to be less difficult as the systems requirements are collected and designed together during hospital construction and in line with hospitals missions and goal. However, for existing hospitals, it is important to examine whether the systems to be implemented are compatible with the existing ICT

infrastructure. Focusing on the technical aspects is one of the implementation challenges. Nevertheless, human factor proved to poses more challenges in implementation at the system [8, 5].

Human plays significant role in HIS adoption in hospitals. Human refer to skill, experience and self-awareness of hospital staff members to deal with HIS [2]. Factors affecting adoption are different between hospitals and information system type and human context is one of the important factor in influencing the HIS adoption in Malaysia Public Hospitals [4]. Failure of HIS implementation is closely related to the level of acceptance among medical practitioners [9].

Human factors are essential in identifying human constraint and needs when interacting with the system for improving work effectiveness and productivity. Human factors is focused on the system users, who are the medical practitioners consists of doctors, nurses, surgeons, pharmacists etc. Medical practitioner is expected to adequately interact with information system implemented in the hospital. Failure of interaction between human and technology implemented might lead to medical errors. Thus, medical practitioners must have the necessary knowledge to operate HIS and adequately react to possible errors [10]. There must exist a good 'fit' between user and technology to render the successful implementation of HIS [11]

Acceptance from users need to be concerned as the system purposely created for them. Human as the system users cause many threats to HIS [12]. Greater insight into understanding medical personnel need to be considered during HIS implementation. Any issue encounters by medical practitioners need to be identified earlier to avoid greater changes once the system is launched. According to [13], barrier comes from healthcare personnel can be related to the use and acceptance of the system applied in the hospital. This has led to investigate on the factors that motivate and limit the implementation of information technology in healthcare domain. Thus, the objective of this study is to identify limitations of HIS implementation from human factor aspects.

RESEARCH METHODOLOGY

Based on the term "Hospital Information System", "Electronic Health Record", and "human factor", articles were retrieved from two types of electronic journal databases; indexing database (Google Scholar) and full-text database (Science Direct, Bio Med, Emerald, Elsevier, PubMed, Springer, IEEE, etc.). To get a comprehensive bibliography, a systematic search techniques applied using keywords, phrases, synonyms, Boolean connector (AND, OR and NOT) etc. Some inclusive criteria such as year of publication from 2010 and above, articles related to human factors, articles written by local and international scholars were also applied. Articles meets exclusive criteria like not contained keyword, articles published before 2010, incomplete manuscripts, articles with incomplete information and articles written in language other than English were excluded from the review.

Based on the analysis and evaluations carried out on these articles, there are constraints on human factors with the adoption of information system in hospital. After summarizing all factors, the following are the constraints related to human factors: staff resistance in using HIS, lack of IT knowledge among practitioners, staff refuse to share information and the shortage of IT manpower to regulate the system implementation. These factors are elaborated in details below.

HUMAN FACTOR CHALLENGES

Human factors are essential in identifying user needs, user expectation and user acceptance while interacting with HIS. Medical practitioners as the primary users of HIS should be given special rights and privileges to ensure the system achieve its implementation targets. Previous literature identified the challenges during HIS implementation. The challenges that come from human factor should be taken seriously to ensure that the problems are identified and solution are provided.

Based on reviews, following are the challenges among medical practitioners shown graphically in Figure-1; staff resistance in using the implemented system, lack of IT knowledge among practitioners in using HIS, refuse to share information, and the shortage of IT manpower to regulate the system.

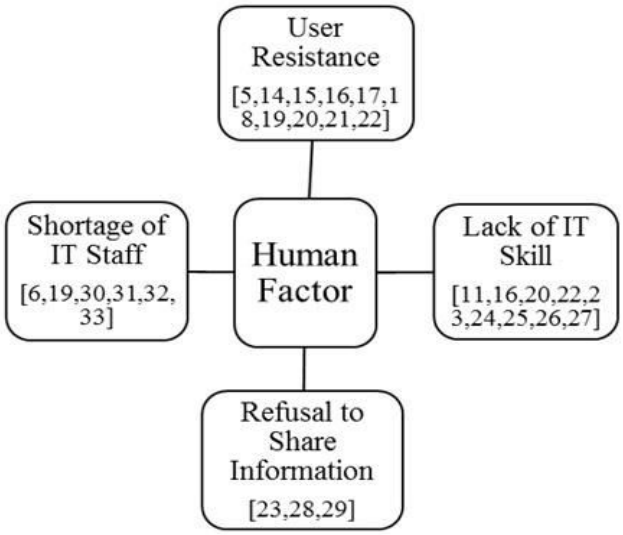

Figure-1. Human factors challenges for HIS implementation.

Resistance among users

Each medical practitioner is different as they practice different approach in providing medical treatment to the patients. Some medical personnel gave negative perception and even indicated negative attitudes towards the implementation of new technology in hospital [14]. Since HIS is introduced, users unwilling and having difficulties to adopt the system in their work routine [15]. Korea is a country with a great level of technology

compared to other developing countries, but the implementation of information systems in the medical field still facing resistance among medical practitioners and similar problems also occurs in China [16].

Migration of paper-based system to a computer-based system caused challenges on acceptance among medical practitioners [17]. Before the arrival of HIS, doctors and nurses use paper-based system where they wrote manually on patients' progress report for both inpatient and outpatient. This traditional approach seems to work well previously, but not suitable to apply now, especially the number of treatments requested keep increasing. HIS makes medical practitioners feel insecure with their job as they are required to use the system in their work [5].

The use of advanced application system proved to be difficulty for the system users as they are not adopted to manage the application which will cause them to refuse to cooperate in the HIS implementation [18]. As hospital traditionally uses paper-based system, HIS can be seen as an advanced technology where the system able to reduce some of the medical practitioners' task. Problems face by some user as they need to be a fast learner and familiar with the new electronic record system. Therefore, resistance arises due to time constraints to familiarize themselves and enhance their skills in using the system [19].

Furthermore, the system complexity is believed to be the reason of users' resistance to the implementation [19,20,21] of hospital information system [22]. Research done by [21] founded that the system's poor interface and less user friendly cause resistance from users. Medical practitioners come from various age groups (senior or young practitioners) with different level of exposure to technology. The system interface is crucial and required high concerned from the system developer especially the font, color, size, etc. Resistance among senior staffs is common due to HIS poor interface. They usually prefer simple and easy-to-read system to be worked with. Moreover, as HIS is applied to assist medical practitioners, the system is expected to be easily used with minimum error.

In addition, HIS resistance for the reason that the system is inconvenient to be used in wards. In some situation, nurses are required to gather vital data from inpatient (patients admitted to the hospitals). Nurses had to frequently return to the computer to retrieve and update patients' information. This leads to waste of time because nurses have to move from patient bed to the nurse's station. Medical personnel need to perform tasks regularly without any obstacles that could lead to delays in providing patient treatment. Use of mobile devices that can be connected directly to the system able to speed up their work to retrieve and update patient information. Both these activities can be continued during treatment without delay. The summary of user resistance are shown in Table-1.

Table-1. Summary of the reasons of resistance among medical practitioners.

Reasons	Representative source
Negative perception and negative attitude from medical personnel	Ahmadian, Khajouei, Nejad, Ebrahimzadeh, and Nikkar, 2014
Change in work routine from paper-based to computerized	Hassibian, 2013 Mohd Amin, Sumarni Hussein, and Wan Mohd Isa, 2011
Unwilling to be distracted from their comfort zone	Lee, Ramayah, and Zakaria, 2012
Advanced system and system complexity	Qureshi, Shah, Khan, Miankhel, and Nawaz, 2012 Mohd Fadhil, Jusop, and Abdullah, 2012 Boonstra and Broekhuis, 2010
Time constraints to familiarize with HIS	Nugawela and Sahama, 2011
Lack of motivation and support for new technologies	Qureshi, Shah, Khan, Miankhel, and Nawaz, 2012

Lack of IT skilled among healthcare practitioners

Implementing Healthcare Information System requires people with skilled that have knowledge on both healthcare, and Information and Communication Technology (ICT) [23, 24]. Knowledge and skills using the system have become the biggest challenge faced by medical practitioners [25, 22]. This is because HIS users need to feel comfortable when using the system by having basic IT knowledge and experience, which users can adapt to the system easily.

HIS acceptance in Malaysia is low due to lack of computer skilled among medical practitioners [20]. Even in China and Greece, insufficient knowledge of computer literacy restrained the adoption and implementation of HIS [16, 26].

In details, problem with IT literacy usually derives from senior medical personnel because they are less exposed to the ICT. Previously, medical practitioners do not require a computer in performing their daily tasks which make them unskilled to work with the new system [20, 11].

The 'fit' between users and technology demands attention because they are likely to influence user acceptance towards implementation of HIS [11]. Lack of computer skills could cause anxiety and stress as medical practitioners need to be capable in handling HIS. Training is necessary to ensure medical personnel have the necessary skills and ability to fully utilize the system

Another justification identifies that medical practitioners receive insufficient training to assist them in using the system [27]. Implementation of healthcare information system certainly has goals to achieve. To ensure the effective implementation of those targets, medical practitioners should be skilled in medicine and also not awkward to adopt the technology in their daily tasks. Therefore, adequate training should be given to those employees who will use the system. Reasons for lack of IT skilled have been cited are shown in Table-2.

Table-2. Summary of the reasons of insufficient IT skilled among medical practitioners.

Reasons	Representative source
Requires knowledge on medical and ICT	Gao, Xu, Sorwar, and Croll, 2013 Hersh, Margolis, Quirós, and Otero, 2010
Medical practitioners have lack of computer skills	Ismail and Abdullah, 2011 Chen & Lee, 2012 Fragidis and Chatzoglou, 2011
Senior practitioners less exposed to computer	Hassan and Megat Tajuddin, 2012
Insufficient staff training	Ahanhanzo, et al., 2014
Poor fit between user and technology	Mohamadali and Garibaldi, 2012

Refrain from information sharing

One of the goal in adopting Healthcare information systems (HIS) is the medical practitioners should be able to exchange information among themselves within hospitals. HIS provides an opportunity for doctors and nurses to exchange views and experience in dealing with patients. This information can be used by others who faced similar situations. In addition, sharing of information should be a common practice among the medical practitioners since they came from different generations, and by sharing their medical knowledge, they could strengthen the ties between colleagues. For instance, in some situation, doctors have a problem to identify patients' illness and treatment. HIS can be a platform for the doctors to find answers by searching previous medication with similar diagnosed which were input previously by other medical doctors through the systems.

In real situation, medical practitioners are refusing share information with other medical doctors. Reason given was there is no guidance issued by the hospital management that encourages employees to share information. Moreover, the decision to share information is an individual right where they can choose to contribute or refuse [23]. Knowledge and experience usually transferred in class, conference or any physical meeting. To gather knowledge and experience by making it available in the system will take time and sometimes the message is not well delivered compare to direct communication. With no guidance, medical practitioners are not inspired to record their information.

Sharing information can also happen between hospitals. However, in the United States, larger hospital are less likely to exchange information externally [28]. Hospitals avoid information sharing because concern of information discloses especially on critical information matters. At the same time due to personnel's proficiency, they fear to be criticized by medical professionals from the other hospitals. Even though criticism can give positive vibes, it might affect hospital's reputation.

In some situation, information exchange unable to be practiced due to system interoperability issue. Interoperability issue happens when different medical equipment and information systems unable to exchange and interpret data accurately, effectively and consistently due to incompatibility between equipment and system. This issue lead to the result of the diagnosis not recognized and instrument's accuracy is being questioned [28]. Thus, in order to facilitate information exchange between medical practitioners and hospitals, an appropriate system which are capable of communicating through various ICT infrastructure should be adopted.

Apart from sharing knowledge and experience, medical practitioners also encouraged to be participated in the system development process to ensure that the system will be build according to their requirements. HIS developer need to identify system requirements in depth and it can be done by receiving information from those who work in the hospitals with knowledge and experience on all processes and procedures involved in daily tasks. No cooperation during the development stage makes HIS implementation in Ghana encountered challenges [29].

HIS implementation can be carried out successfully if the medical practitioners practicing a culture of sharing knowledge and experience that commonly known will be a positive impact on the medical field. Reasons to refrain from sharing information are shown in Table-3.

Table-3. Summary of the reasons of refusal in sharing information.

Reasons	Representative source
No general guidance	Gao, Xu, Sorwar, and Croll, 2013
No recognition due to personnel's proficiency and instrument's accuracy	Miller and Tucker, 2014
Less commitment during development stage	Achampong, 2012

Shortage of IT staff

Limited resources, including ICT manpower and infrastructure are among common problems faced by hospitals when implementing healthcare information system. The flaws lead to lack of trained manpower in handling HIS as well as promoting acceptance and use of the system. Unavailability of well-trained IT staffs become a barrier in Pakistan, Oman, Saudi Arabia and Syria [30, 31, 32].

Implementing HIS require sufficient IT manpower to be available 24-hour a day as the system requires expert in this field for continued support and assistance [33, 6]. Furthermore, workers should be highly motivated in performing their duties and willingly to make improvements to the system if required according to the needs of medical industries [19].

HIS is normally maintained by IT personnel under the Information Technology Department (ITD). However, IT employees have the responsibility of maintaining basic technical requirements in hospitals, including telephone, internet connection, computer and other equipment. The use of the system directly adding to their daily duties and even they may not be able to solve all the technical problems reported daily.

Due to the pile of daily tasks, additional IT manpower is necessary to support system difficulties or system errors. Maintaining the efficiency of HIS implementation in an organization must be carried out by employing a workforce that own skills in medicine and information system [19]. Reason for IT manpower shortage is shown in Table-4.

Table-4. Summary of the reason of shortage IT manpower.

Reason	Representative source
Lack of IT trained manpower employed	Gerber, Dlazabal, Karl, and Pablos-Mendez, 2015 Ismail, et al., 2010
Unavailability of IT staffs as workload growth	Al-Gharbi, Gattoufi, Al-Badi, and Al-Hashmi, 2015 Hayajneh and Zaghloul, 2012 Anwar and Shamim, 2011
Lack of workforce with both medical and information system skills	Nugawela and Sahama, 2011

STRATEGIES TO OVERCOME HUMAN FACTORS IN HEALTHCARE INFORMATION SYSTEM (HIS)

In general, healthcare professionals aware of the HIS benefits and realize the need to adopt the system for more efficient and more coordinated daily work. Challenges in implementing HIS is not new, difficulties in the area of human factors need to be identified and resolved quickly as its do influence the success of information system adoption in hospital. Based on the review, various strategies and approaches were suggested to tackle the issues related to human factors such as user involvement, providing continuous training, medical practitioner representatives and management role. These strategies are clearly shown in Table-5 and discussed below in details.

User involvement

Hospitals consist of units, wards, labs, etc., which have different working procedures. Each procedure needs to be clearly identified to avoid missing process. This makes developing healthcare system is not easy without complete understanding on the requirements. Potential users of HIS should be encouraged to participate and provide insights regarding the system requirements, design and implementation.

Getting user involvement in system design and development process can reduce the problem of system implementation [3]. User involvement has to be included from the first stage of the system development so that they are not left behind. The wide range of user requirements, combined with the difficulties of designing a system which meets variety of clinical needs, was the main reason to include users. Thoughts from all, particularly stakeholders is important and essential to ensure the system is implemented according to medical specifications required [25]. Views and issues raised should be studied carefully to ensure the quality of the system and can help practitioners deal with daily tasks. In addition, involving users makes them feel important to be part of the development committee.

To have a complete view on healthcare practices, representatives from each unit who work directly with patient shall participate in information gathering. User participation does not end after the developer done collecting requirements, users are required to involve until the system's final delivery (launch). This approach can ensure the system developed successfully according to healthcare practices.

Providing continuous training

Medical practitioners have different level or IT literacy and system training is important before they begin to use the HIS. HIS implementation requires every medical staff at least be able to utilize a computer, therefore workers should be given adequate training to ensure they are skilled and able to increase computer literacy skills under supervision of the system expertise [14].

Training is a method for knowledge delivery, to increase users understanding of operating HIS. Furthermore, training is important for users to be computer literacy users even they will be more satisfied when using the system [14]. Training should be compulsory for all users as technical problems from misusage can be reduced [6].

Training may gain comfortable feeling when using HIS among healthcare personnel. They should be given sufficient training to utilize the technology [34]. Management needs to identify and group their staffs so those who require more IT practice will have extra attention from the training team. The system should be introduced to the users early before its release so that they able to adept at using the system and ready to change the way they work with the new working process [20]. Training programs should be designed to achieve user understanding and ability to operate the system independently. In addition, users' requirement can be determined either it is to fulfill by the system. Progress training report needs to be prepared to observe users' ability.

Furthermore, HIS is a system that will continuously evolve and regularly upgraded according to the medical activities to incorporate newer modules if required. The system is always changing and improving, including HIS that requires users to go through a series of continuous training [3]. Thus, continuous training should be given to those who are using the system to ensure users' experts in handling and reducing the risk of system failure due to incompetence [6]. However, continuous training is overburdening to medical practitioners as they need to add extra workload to their compact schedule. Therefore, training must be well planned. Training and guidelines should be made available to medical practitioners which later able to motivate them to accept changes [25].

Medical practitioner representative

Medical practitioners work in different roles including physician, surgery, nursing, midwifery and other health professionals which make a hospital has many workers. Providing system training to all workers is costly and require time. Furthermore, the hospital consists of many departments and units that are impossible to train all medical practitioners because of time and likely to need more money to provide training to all. HIS users require training to successfully interact with the system.

The hospital management can choose several representatives among medical practitioner who has the skills to use the system, to be part of the committee to train and supervise other medical workers [20]. Computer skills are a basic requirement for a medical practitioner in this era and these factors facilitate their acceptance as it is comfortable and not awkward when using HIS. Furthermore, peer influence, especially among physician and nurses can convince and persuade other users to accept the system [19]. This method can assist management and system development in identifying the problems faced by novice users.

Once the practitioners competent to use the system, they can assist and guide other staffs who still adjusting themselves to adopt the system [20, 22]. Gap between users and trainer can be reduced as they feel comfortable being taught by people they know. At the same time, this approach can reduce training phase and the remaining time can be used to solve other issues. Then, management should appoint representatives among them to get along closely with the medical staff and to take care of every little problem arises as systems being used by the medical doctors.

Management role

Before the implementation of HIS, hospital management need to have regular discussion, in other to identify benefits, challenges, users motivation and acceptance towards a new system [35]. One issue to be discussed is HIS acceptance from medical practitioners as the system will be adopted for them. To ensure the success of HIS, management is responsible to reach full consent from medical practitioners [3]. User acceptance can be reached by giving clear information, including the benefits of adopting the new system and assure that their position will remain even after the system is applied [14]. Hence, management must give close attention and take appropriate actions to ensure that employees are aware of the potential benefits and lighten their daily tasks.

Moreover, as HIS is a new adopted system, close supervision from management is a need to ensure each employee able to handle and use the system. This approachable to measure practitioners' acceptance towards the system and at the same time to identify a problem face by users for improvement. In addition, regular meeting between management and representatives from practitioners, together with Information Technology Division (ITD). This meeting can be a good platform to gather positive or negative feedback from users. Moreover, suggestion and solution to the identified issues can be reached, then fast action can be taken.

Representative from management should be appointed to act as mediator between management and medical staff, which are also responsible for receiving any complaints or suggestions. A champion found to be a person or representative(s) who is able to motivate and inspire in recognizing the usefulness of HIS and in achieving successful adoption and implementation of information system to ensure everyone involved throughout the processes [8]. The champion shall be chosen among those who admired, respected, someone who has charisma, trust, and able to suggest solutions and can receive suggestions from others to ensure that stakeholders are always satisfied with the system adopted.

In addition, policies should be issued to encourage medical practitioners using HIS. Likewise, the management is responsible to enforce the policies [3]. At the same time, close support and encouragement from top management can motivate and inspire medical

practitioners to use HIS in their daily duties in order to adopt the system. Summarization on the strategies to overcome human factors issues are shown in Table-5.

Table-5. Strategies to overcome human factors challenges in HIS.

Strategy	Representative source
User involvement during system development	Chao, Hu, Ung, and Cai, 2013 Abdul Karim and M. Ahmad, 2010
Training (including basic knowledge for novice users)	Ahmadian, Khajouei, Nejad, Ebrahimzadeh, and Nikkar, 2014 Singh and Muthuswamy, 2013 Chao, Hu, Ung, and Cai, 2013 Hassan and Megat Tajuddin, 2012 Ismail, et al., 2010 Abdul Karim and M. Ahmad, 2010
Select representative among medical practitioners	Hassan and Megat Tajuddin, 2012 Nugawela and Sahama, 2011 Boonstra and Broekhuis, 2010
Management roles	Ahmadi, et al., 2015 Ahmadian, Khajouei, Nejad, Ebrahimzadeh, and Nikkar, 2014 Qureshi, et al., 2014 Abdul Karim and M. Ahmad, 2010

Strategies mentioned above may be able to resolve issues that come from human factor. The outlined strategies could be practices in every hospital implementing HIS and it requires full cooperation and commitment from all stakeholders.

CONCLUSIONS

Human factors is a challenge that hold the success of HIS implementation in hospitals. Medical practitioners' acceptance and satisfaction towards the system is important as they are the main users and this should be taken seriously as they will determine either HIS implementation is a success or a failure. Identify the barriers for HIS Implementation is crucial for management as it determine implementation success.

Information system is expected to facilitate users' daily tasks so challenges must be identified and solved quickly in order to ensure full adoption of HIS in the hospitals. This paper is written based on reviews from various articles. Based on this study, it is suggested that all stakeholders need to participate in dealing with the identified issues from human aspects and to adopt or consider the strategies outline in this study in order to maximize the use of systems in the hospital and minimize losses due to lack of acceptance among users.

For future research, detailed observation and investigation in hospitals is necessary to discover more issues or problems related to human factors and to propose suggestion to overcome the problems, if any. In addition, interviewing medical practitioners can get a clear idea of the issue or situation they face when operating the system. Ideas and suggestion from users able to improve the quality system and achieve the original goal of using the system in the hospitals.

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REFERENCES

[1] N. I. Ismail and N. H. Abdullah. 2012. "An Overview of Hospital Information System (HIS) Implementation in Malaysia," in International Conference on Business and Economic Research, Bandung, Indonesia.

[2] N. I. Ismail, N. H. Abdullah, A. Shamsudin and N. A. Nik Ariffin. 2013. "Implementation Differences of Hospital Information System (HIS) in Malaysian Public Hospitals," International Journal of Social Science and Humanity, pp. 115-120.

[3] N. S. Abdul Karim and M. Ahmad. 2010. "An Overview of Electronic Health Record (EHR) Implementation Framework and Impact on Health Care Organization in Malaysia: A Case Study," in Management of Innovation and Technology (ICMIT), Singapore.

[4] N. I. Ismail, N. H. Abdullah and A. Shamsuddin. 2015. "Adoption of Hospital Information System (HIS) in Malaysian Public Hospitals," in Procedia-Social and Behavioral Sciences, Kuala Lumpur.

[5] H. W. Lee, T. Ramayah and N. Zakaria. 2012. "External Factors in Hospital Information System (HIS) Adoption Model: a Case on Malaysia," Journal of Medical System, pp. 2129-2140.

[6] A. Ismail, A. T. Jamil, A. F. A Rahman, J. M. Abu Bakar, N. Mohd Saad and H. Saadi. 2010. "The Implementation of Hospital Information System (HIS)

in Tertiary Hospitals in Malaysia: A Qualitative Study," Malaysian Journal of Public Health Medicine, pp. 16-24.

[7] H. Sulaiman and N. Wickramasinghe. 2012. "Assimilation of Healthcare Information System (HIS): An Analysis and Critique," in Critical Issues for the Development of Sustainable eHealth Solutions, Taiwan, Springer, pp. 49-70.

[8] H. Ahmadi, M. Nilashi, O. Ibrahim, T. Ramayah, M. W. Wong, M. Alizadeh, H. Jafarkarimi and A. Almaee. 2015. "Exploring Potential Factors in Total Hospital Information System Adoption," Journal of Soft Computing and Decision Support Systems, pp. 52-59.

[9] N. A. K. S. Mohamadali and J. M. Garibaldi. 2010. "A Novel Evaluation Model of User Acceptance of Software Technology in Healthcare Sector," in International Conference on Health Informatics, Valencia, Spain.

[10] A. Sagi, A. Sabo, B. Kuljić and T. Szakáll. 2013. "Intelligent System and Human Factor Caused Medical Errors," in International Symposium on Intelligent Systems and Informatics, Subotica, Serbia.

[11] N. A. K. S. Mohamadali and J. M. Garibaldi. 2012. "Understanding and Addressing the 'fit' between User, Technology and Organisation in Evaluating User Acceptance of Healthcare Technology," in 5th International Conference on Health Informatics, Vilamoura, Algarve, Portugal.

[12] A. B. Shahri and Z. Ismail. 2012. "Human Factors as the Biggest Threats to Security of Health Information System," International Journal of Communications and Information Technology, Vol. 1, No. 2, pp. 29-33.

[13] A. H. Turan and P. C. Palvia. 2014. "Critical information technology issues in Turkish healthcare," Elseveir: Information & Management, p. 57–68.

[14] L. Ahmadian, R. Khajouei, S. S. Nejad, M. Ebrahimzadeh and S. E. Nikkar. 2014. "Prioritizing Barriers to Successful Implementation of Hospital Information Systems," Journal of Medical Systems, pp. 1-6.

[15] I. Mohd Amin, S. Sumarni Hussein and W. A. R. Wan Mohd Isa. 2011. "Assessing User Satisfaction of Using Hospital Information System (HIS) in Malaysia," in International Conference on Social Science and Humanity, Singapore.

[16] Y. Chen and J.-k. Lee. 2012. "Analysis and evaluation about the barriers of the adoption and implementation of Electronic Health Record system: A comparison study between China and Korea," in International Symposium on Information Technologies in Medicine and Education, Hokodate, Hokkaido.

[17] M. R. Hassibian. 2013. "Electronic Health Records Acceptance and Implementation in Developing Countries: Challenges and Barriers," Razavi International Journal of Medicine, pp. 11-16.

[18] Q. A. Qureshi, B. Shah, N. Khan, A. K. Miankhel and A. Nawaz. 2012. "Determining the Users' Willingness to Adopt Electronic Health Records (EHR) in Developing Countries," Gomal University Journal of Research, Vol. 28, No. 2, pp. 140-146.

[19] S. Nugawela and T. Sahama. 2011. "Barriers to the Adoption of Health Information Technology," in International Conference on Innovation and Management, Kuala Lumpur.

[20] R. Hassan and M. Z. Megat Tajuddin. 2012. "Implementation of Total Hospital Information System (THIS) In Malaysian Public Hospitals: Challenges and Future Prospects," International Journal of Business and Social Research, pp. 33-41.

[21] N. F. Mohd Fadhil, M. Jusop and A. A. Abdullah. 2012. "Hospital Information System (HIS) Implementation in a Public Hospital: a Case Study from Malaysia," Far East Jounal of Psychology and Business.

[22] A. Boonstra and M. Broekhuis. 2010. "Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions," BMC Health Services Research.

[23] X. Gao, J. Xu, G. Sorwar and P. Croll. 2013. "Implementation of E-Health Record Systems and E-Medical Record Systems in China," The International Technology Management Review, pp. 127-139.

[24] W. Hersh, A. Margolis, F. Quirós and P. Otero. 2010. "Building A Health Informatics Workforce In Developing Countries," Health Affairs, pp. 274-277.

[25] W. C. Chao, H. Hu, C. O. L. Ung and Y. Cai. 2013. "Benefits and Challenges of Electronic Health Record System on Stakeholders: A Qualitative Study of Outpatient Physicians," Journal of Medical Systems, pp. 1-6.

[26] L. L. Fragidis and P. D. Chatzoglou. 2011. "The Use of Electronic Health Record in Greece:Current Status," in 11th IEEE International Conference on Computer and Information Technology, Cyprus.

[27] Y. G. Ahanhanzo, L. T. Ouedraogo, A. Kpozèhouen, Y. Coppieters, M. Makoutodé and M. Wilmet-Dramaix. 2014. "Factors Associated with Data Quality in the Routine Health Information System of Benin," BioMed Central, Vol. 72.

[28] A. R. Miller and C. Tucker. 2014. "Health Information Exchange, system size and information silos," Journal of Health Economics, Vol. 33, pp. 28-42.

[29] E. K. Achampong. 2012. "Electronic Health Record System: a Survey in Ghanaian Hospitals," OMICS Publishing Group Journal.

[30] K. N. Al-Gharbi, S. M. Gattoufi, A. H. Al-Badi and A. A. Al-Hashmi. 2015. "Al-Shifa Healthcare Information System in Oman: a Debatable Implementation Success," Electronic Journal on Information Systems in Developing Countries, Vol. 66, pp. 1-17.

[31] Y. A. Hayajneh and A. A. Zaghloul. 2012. "Barriers to the Adoption of Health Information Technology in Arab Countries' Hospitals : Practitioners' Perspective," in 24th International Conference of the European Federation.

[32] F. Anwar and A. Shamim. 2011. "Barriers in Adoption of Health Information Technology in Developing Societies," International Journal of Advanced Computer Science and Application, Vol. 2, No. 8, pp. 40-45.

[33] T. Gerber, V. Dlazabal, B. Karl and A. Pablos-Mendez. 2015. "An Agenda for Action on Global e-Health," Health Affairs, pp. 235-238.

[34] B. Singh and P. Muthuswamy. 2013. "Factors Affecting the Adoption of Electronic Health Record by Nurses," World Applied Sciences Journal, pp. 1531-1535.

[35] N. A. Qureshi, Q. A. Qureshi, K. A. Chishti, G. M. Kundi, S. Khan, R. Akhtar and I. Khan. 2014. "An Analysis of e-Health in Public Sector Hospitals of Developing Counties," Gomal University Journal of Research, pp. 1-10.