

# Acceptance of Total Hospital Information System (THIS)

Noor'ain Mohamad Yunus, Dilla Syadia Ab Latiff, Zamzaliza Abdul Mulud, and Siti Noorsuriani  
Ma'on

**Abstract**—In Malaysia, Selayang Hospital has been the pioneer in the implementation of Total Hospital Information System (THIS) as an integrated care delivery system. However, shifting from the conventional method of reporting and organizing data and records using pen and paper to a computerized system was not an easy process. Users' acceptance and satisfaction play essential roles in the successful of the system. The major problem with THIS is the system performance and capabilities which influence the level of acceptance and satisfaction among the users of THIS. Therefore, the primary concern of this study is to examine the role of THIS capability that mediates the relationship between system acceptance and users' satisfaction. This cross-sectional study was conducted in the Selayang Hospital. Data were collected from participants who were nurses working in various disciplines in the hospital. Three hypotheses were formulated to guide this study. The findings suggest that perceived usefulness is related to system capability, perceived ease of use is related to system capability and nurses' satisfaction and therefore all three hypotheses are supported. However, it is recommended that caution be taken in crediting the level of acceptance solely from predicting the capabilities and successfulness of a system. Other factors such as the users' attitude, intention to use and the influence of trust towards the system should be further explored.

**Index Terms**—Capabilities, nurses' acceptance, technology acceptance model (TAM), total hospital information system (THIS)

## I. INTRODUCTION

User satisfaction is one of the essential criteria for system success. Measuring the value and effectiveness of the information system investment by evaluating users' satisfaction and its determinant is an important exercise that should be practiced by any organization. The user's acceptance and the most successful in the implementation of hospital information system (HIS) had been identified as the contributing factors of the failure of a number of systems (Meijden, Tange, Troost, & Hasman, 2004). Hussaini (2002), found out that users' acceptance of IT application in their organizations was the main reason why the users' resists changing.

Furthermore, a research carried out by Mohd and Syed Mohamaed (2005) found that the acceptance level of THIS system in IT-Based hospital in Malaysia was still moderately accepted. Hospital Information System (HIS) had rapid growth and the nurses are the main end users of the system (Chan, 2007). Therefore, the nurses' attitude towards its use plays imperative roles in the successful implementation of the computerized system (McLane 2005,

Sassen 2009). There are several problems encountered in the implementation of THIS which are organizational and behavioral and may be attributed to attitudes toward the use of the technology.

For advocating user acceptance of information system, it is thus important to ensure an appropriate level of fit between the user needs and expectations. Users acceptance constructs of Technology Acceptance Model (TAM), such as perceived usefulness and perceive ease of use have been well investigated to capture the acceptance of information system use on satisfaction. In determining the acceptance also, system capability has been widely studied as a key factor in ensuring the success of the system.

Review of the literature indicates that number of studies investigating the acceptance of information technology system in health care settings was limited. Therefore, the purpose of the study is to examine the influence of user's acceptance on the capability of the system. The study also investigates the mediating role of system capability on the link between user's acceptance and satisfaction.

## II. REVIEW OF LITERATURE

In establishing the future of the health care system, Ministry of Health (MOH) has taken an important step by introducing the Information and Communication Technology (ICT). The introduction of healthcare information system (HIS) has made a significant positive impact on the healthcare sector. In recent years, there are an increasing number of hospitals integrating Healthcare Information Systems (HIS) into their computing environment. In Malaysia, Selayang Hospital is the first paperless hospital operating a Total Hospital Information System (THIS) which integrates clinical, administrative and financial management.

Electronic Health Records (EHR) are defined as patient medical records relating to various sources such as patient episode of care, diagnosis, lab test, history, allergies, treatment and personal information. EHR can be accessed anywhere by the users within the hospital with the protection of security to protect the privacy and confidentiality of the patient's record. In Malaysia, the infrastructure of EHR may not be consistent across the country and with other healthcare facilities. Such issues and challenges need to be addressed once the telehealth or e-health system is fully implemented in healthcare facilities nationwide. Inadequate telecommunications infrastructure would jeopardize the availability, accessibility and maintenance of the patient medical records (Khanapi, Bali, Naguib, & Marshall, (2008).

In this study, TAM is particularly customized for modeling user acceptance of information technology.

Holden and Karsch (2010) agree that TAM is a fit model in forecasting the factors that cause an individual to accept information technology in the healthcare perspective. User acceptance is defined as the willingness within a user group to employ information technology to the tasks it is designed to support (Venkatesh, Morris, Davis & Davis, 2003). User acceptance is therefore a pivotal factor determining either success or failure in the implementation of information systems.

Acceptance is defined as the willingness within a user group to employ information technology to the tasks it is designed to support (Dillon & Morris, 1996). One of the factors to the user's resistance to change is highly related to the user's acceptance of IT application in their organization (Hussaini, 2002). In order to enhance the acceptance level of Electronic Health Records, proper strategies and guidelines by the hospital and the Ministry are needed. A research conducted by Mohd and Syed Mohamaed (2005) found that the acceptance level of THIS system in IT-based hospital in Malaysia is still moderately accepted.

Perceived usefulness is the factor that indicates the degree to which the individual believes that the use of information system would increase his/her job performance. Perceived ease of use is the other factor, which is used to indicate how difficult the person believes that the proposed system would be to use. Perceived ease of use is 'the extent to which a person believes that using the system will be free of effort (Venkatesh, Morris, Davis, & Davis, 2003).

For an EHR to be easy to use, it needs customization and practice unique needs. Each department has different interfaces in dealing with system thus it needs to be customized. Developers of the system must understand users' needs in producing system and help healthcare providers used these tools efficiently in care delivery.

The capabilities of THIS thus are the main concern in ensuring the success of the system. It is said that the system is generally slow and interrupted constantly. These drawbacks have affected the clinical staff to complete their reports efficiently and further caused delay in the documentation process.

The successful implementation and users' satisfaction of THIS would serve in facilitating and improving the quality of patient care. This will further strengthen the areas of health care quality; tourism and informatics which provide MOH with the competitive edge on the international platform that align with the MOH Strategic Plan.

### III. RESEARCH FRAMEWORK AND HYPOTHESES

In the context of this study, the independent variables in this study are perceived usefulness and perceived ease of use whereby these variables were adopted from the TAM model which is developed by Davis (1989). The dependent variable for this study is nurses' satisfaction and the mediating variable is THIS capabilities. The discussion leads to the following hypotheses:

- H1: Perceived usefulness is related to THIS capability
- H2: Perceived ease of use is related to THIS capability
- H3: THIS capabilities relate with nurses' satisfaction

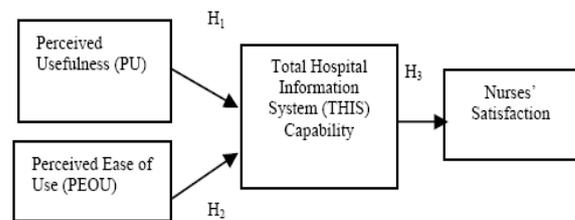


Fig. 1. Conceptual model

### IV. METHODOLOGY

In information system studies, measuring for the uniformity of the systems and applications which are being evaluated is important for ensuring responses consistency and data. Hence, data were collected from nurses at the Selayang Hospital. A total of 350 questionnaires was distributed and 249 were returned, which contributing 71.14% to the response rate.

Perceptual measures were used to capture data as these measures are most acceptable and commonly employed in previous survey research. A four point Likert scales ranging from strongly disagree to strongly agree for each construct used as a measurement tool. In addition to that, the study adapted measurement items from several studies; (i) a total of nine items from Davis et al (1989) to operationalise PU (4 items) and PEO (5 items) and (ii) a total of 15 items from Shneiderman (2004) to operationalise system capabilities (5 items), performance of clinical tasks (5 items) and users' satisfaction (5 items).

In determining the reliability of the survey instruments, a pilot study was conducted to 30 nurses and the overall results of  $\alpha=0.953$  indicates the questionnaire was reliable for the study. The test yields that the individual constructs reliability range from 0.819 to 0.944. The data, therefore suggested that the questionnaire was a reliable instrument to consistently measure the level of each variable of the study.

Factor analysis with varimax rotation was performed to ascertain perceived of usefulness, perceived ease of use, system capabilities, performance of clinical tasks and users satisfaction are distinct constructs. The results confirmed that the existence of the five constructs with eigenvalues greater than 1.0 was accounted for 80.32% of the total variance. The correlation matrix shows no value exceeds 0.85 had suggested for the none existence of multicollinearity. The KMO value of 0.871 signifies that factor analysis is appropriate.

For research that involves Ministry of Health Malaysia (MOH) sites, patients and personnel must be registered under the National Medical Research Registry (NMRR) and received the approval of the hospital. Through ethics application to the NMRR, this study obtained the ethics approval from the Hospital Director and Head of Department, Nursing Selayang Hospital. Finally, Medical Research and Ethics Committee (MREC) issued an approval letter (NMRR-11-349-8297), after the ethical approval application were reviewed. Prior to obtain informed consent from the participants, information sheets describing the nature of the study and the anonymous questionnaire were given to all selected nurses.

V. RESULTS

Demographic data were analyzed by using descriptive statistics. Multiple regressions were further performed to investigate the relationship between variables. Detailed of the results are shown in the following section.

A total of 249 nurses was analyzed for the demographic variables including gender, age and working experience. The majority (93%, n=232) of the nurses were female. A total of 112 nurses were in range age of 30-39 years old, whereas 6% (n=14) of the nurses were 50 years and above. Fifty one percent (n=128) nurses had more than 6 years of working experience, whereas 11% of the nurses had less than 1 year of working experience. The demographic backgrounds of the nurses are shown in Table I.

TABLE I: DEMOGRAPHIC BACKGROUND OF THE NURSES

Items	Freq	Percentage
Gender		
Male	13	93.2
Female	232	5.2
Age		
20-29	105	42.2
30-39	112	45
40-49	15	6
50 and above	14	5.6
Years of Working Experience		
< 1 year	28	11.2
1-3 years	37	14.9
4-6 years	54	21.7
> 6 years	128	51.4

TABLE II: DESCRIPTIVE STATISTICS

Scales	Mean	SD	Cronbach Alpha
<i>Perceived usefulness</i>			0.885
Accomplish task quickly	2.9839	.51563	
Improve job performance	3.1365	.52884	
Increase productivity	3.0924	.57106	
Enhance my effectiveness	3.0201	.51938	
<i>Perceived Ease of Use</i>			0.944
Easy for me	3.0683	.51525	
To do what I want it to do	3.0201	.54956	
Clear and understandable	3.0482	.53665	
Skilful at using this	3.0482	.56591	
Easy to use	3.0803	.50158	
<i>THIS Capability</i>			0.819
THIS system speed is Fast enough	2.6599	.62285	
THIS system is always reliable	2.8704	.45912	
The system failure seldom occurred	2.7530	.58412	
The system always warns you about potential problem	2.8462	.66306	
Correcting your mistakes is easy	2.8704	.51740	
<i>Users' satisfaction</i>			0.938
The existing THIS system is stimulating	3.0080	.58193	
I am very satisfied with the existing THIS system	3.0683	.52302	
The THIS system is easy to use	3.0562	.59977	
The THIS system is wonderful	3.0402	.53731	
The existing THIS system is flexible	3.0040	.57850	

Data findings of descriptive analysis and reliability

analysis test are shown in Table II. The THIS perceived of usefulness were examined. The THIS has improved job performance among the nurses (M=3.14; SD= 0.53). However, THIS has delayed the nurses in accomplishing their daily tasks (M=2.9;8 SD= 0.51). Increase productivity (M=2.98; SD= 0.51) and enhance the effectiveness of the nurses' daily task (M=3.1; SD= 0.57) when using the THIS were at average score.

Relating to the THIS perceived ease of use, the nurses strongly believed that THIS is a simple and easy-to-use system (M=3.10; SD=0.51). Although the THIS interface is clear and understandable (M=3.05; SD=0.54), the nurses believed that they have to be skillful to use the system (M=3.05; SD=0.57).

In terms of the capability of THIS, the nurses noted that the system is always reliable (M=2.87; SD=0.46), allows the nurses to revise their daily tasks accordingly (M=2.87; SD=0.46), display warning pop-up menu interaction (M=2.87; SD=0.46). However, the overall mean scores of THIS capability were average.

Nurses' satisfaction towards THIS was measured. The nurses strongly reported that they were very satisfied with the system. The nurses further agreed that the system is easy to use, wonderful, stimulating and flexible, respectively (M=3.06; SD=0.60, M=3.04; SD=0.54, M=3.01; SD=0.58 and M=3.00; SD=0.58).

Multiple regression analysis was used to test the formulated hypotheses. Evidence showed that (i) perceived usefulness and system capability, (ii) perceived ease of use and system capability; and (iii) system capability and users' satisfaction are significantly related. Perceived usefulness and ease of use explains for about 51% variance in the THIS capability. About 51.8% satisfaction variance is explained by THIS capability. Comparing the two predictors, it was found that perceived ease of use is the main predictor of system capability ( $\beta=0.434$ ;  $p<0.00$ ). Therefore, the hypotheses are supported. The results of hypothesis testing are shown in Table III.

TABLE III: HYPOTHESES TESTING

Hypotheses and Relationship	R <sup>2</sup>	B	Sig.	Hypotheses
H <sub>1</sub> : Perceived usefulness is related with system capability	0.510	0.315	.000	Supported
H <sub>2</sub> : Perceived ease of use is related with system capability		0.434	.000	Supported
H <sub>3</sub> : System capability is related with nurses' satisfaction	0.518	0.720	.000	Supported

VI. DISCUSSION

Most studies were conducted in the western countries and culture. Few/Limited studies were found in Malaysia. The understanding of factors that influence nurses' acceptance and satisfaction to adopt THIS is important as the hospital information system becomes increasingly more useful and common place in the healthcare setting. This study examines the applicability of TAM for predicting nurses' acceptance satisfaction on THIS.

The results suggest that PU had a higher score than PEOU. The results of this study corroborated the findings of Davis (1989) and Chan (2007) who stated that PU was significantly more strongly linked to the usage of information system than was PEOU. Results from this study were also consistent with other studies conducted in the information system area. PU has consistently been found to be a strong determinant of intentions to use, whereas PEOU has clearly demonstrated a less consistent effect across studies (Ventakesh & Davis 2000, Chen et al. 2008). For these reasons, the variables of PEOU may not be sufficient to perceive as critical among the nurses.

The analysis further reveals that there is a relationship between system capability and nurses' satisfaction. Similar to the findings of Yung, Khin, John and Herng (2009) that users' satisfaction is positively affected by system capability. The results of these studies were almost the same. However, this study has several limitations. First the sample was small because the researchers only targeted on a particular subject group, nurses at the Selayang Hospital. Next, the study emphasized merely two dimensions of the TAM model in relation to the perceived usefulness and perceived ease of use in measuring the acceptance of THIS among nurses. Thus, caution needs to be taken when generalizing the findings and discussion of other information system model and professional groups.

Despite the limitations, it is recommended that further research should be carried out to investigate the role of trust, users' attitude and intention to use among users. In addition to that, the implication of the study is related to the health care information technology management. It can be explained that in encouraging the users to adopt and use the THIS, the management needs to (i) emphasize the usefulness of the technology to physicians and (ii) focus on the enhancement of the capability of THIS.

#### ACKNOWLEDGMENT

The authors wish to thank Universiti Teknologi MARA (UiTM) for the allocation of fund in conducting this research, Dr Safina Mohammed for her invaluable assistance in the ethical approval process, and the Selayang Hospital for giving valuable support and cooperation to facilitate this study.

#### REFERENCES

- [1] M. F. Chan, "A cluster analysis to investigating nurses' knowledge, attitudes and skills regarding the clinical management system," *Computers, Informatics, Nursing*, pp. 45-54, 2007.
- [2] F. D. Davis, "Perceived usefulness, perceived ease of use, and users acceptance," *MIS Quarterly*, vol. 13, no. 3, pp. 319-340, 1989.
- [3] F. Davis, R. Bagozzi, and P. Warshaw, "Users acceptance of information technology: A comparison of two theoretical models," *Management Science*, vol. 35, no. 8, pp. 982-1003, 1989
- [4] A. Dillon and M. Morris, "User acceptance of information technology: Theories and models," *Annual Review of Information Science and Technology*, vol. 31, (Medford, NJ: Information Today), 1996.
- [5] R. J. Holden and B. T. Karsh, "The technology acceptance model: Its past and its future in health care," *Journal of Biomedical Informatics*, no. 43, pp. 159- 172, 2010.
- [6] R. P. Horton, T. Buck, P. E. Waterson, and C. W. Clegg, "Explaining Intranet Use the Technology Acceptance Model," *Journal of Information Technology*, vol. 14, pp. 237-249, 2001.
- [7] S. A. Hussaini, "Selayang Hospital First in Total Hospital Information System," 2002.
- [8] R. Kerjcie and D. Morgan, "Determining sample size for research activities," *Educational and Psychological Measurement*, vol. 30 , pp. 607-610, 1970.
- [9] M. Khanapi, R. K. Bali, R. N. Naguib, and I. M. Marshall, "Electronic health records approaches and challenges: A comparison between Malaysia and four East Asian countries," *Int. J. Electronic Healthcare*, vol. 4, no. 1, pp. 78-104. 2008.
- [10] S. McLane, "Designing an EMR planning process based on staff attitudes toward and opinions about computers in healthcare," *Computers, Informatics, Nursing*, pp. 85-92, 2005
- [11] H. Mohd and S. M. Syed Mohamed, "Technical Report on The Acceptance for EMR Systems in THIS," 2005.
- [12] S. Shea and G. Hripesak, "Accelerating the use of electronic health records in physician practices," *NEJM*, vol. 192, no. 5, pp. 362, 2010.
- [13] B. Shneiderman, "Designing the User Interface: Strategies for Effective Human- Computer Interaction (3rd edition)," Addison-Wesley Publishers, Reading, MA, 1997.
- [14] M. J. V. D. Meijden, H. J. Tange, J. Troost, and A. Hasman, "Determinants of success of inpatient clinical information systems: A literature review," *J Am Med Inform Assoc*, May-Jun 2003, vol. 10, no. 3, pp. 235-43, Epub Jan 28, 2003.
- [15] V. Venkatesh, M. Morris, G. Davis, and F. Davis, "Users acceptance of Information Technology: Toward a unified view," *MIS Quarterly*, vol. 27, no. 3, pp. 425-478, 2003.
- [16] V. Venkatesh and F. D. Davis, "A theoretical extension of the technology acceptance model: Four longitudinal field studies," *Management Science*, vol. 46, pp. 186-204, 2000.



**Noor'ain Mohamad Yunus** was born in Batu Pahat, Johor Malaysia on 17<sup>th</sup> October 1981. Graduated with: Master of Health Services Management from Griffith University, Queensland Australia in 2008; Bachelor in Office Systems Management, Universiti Teknologi MARA, Shah Alam, Malaysia, 2006; Diploma in Public Administration, Universiti Teknologi MARA, Melaka, Malaysia, 2002. Major field of study is healthcare management. She is currently working as a LECTURER at the Department of Health Administration, Faculty of Business Management, Universiti Teknologi MARA, Puncak Alam Selangor. She has been involved with studies related to social issues in health administration such as Health Informatics, Health Economics and others.