Knowledge Transfer of the Wireless Healthcare Application in Rural Community: A Case Study in Baling, Kedah

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ABSTRACT

Healthcare system in rural area is equally as important as who live in the urban or modern city counterparts. Due to geographically difficulty to access by the modern transportation, wireless communication is one of the possible approaches to reach these areas. On the key aspect is the infrastructure reliability to securing knowledge transfer amongst knowledge of the rural society. This study is to determine the readiness of the rural communities in accepting wireless healthcare applications for the effective transfer of acquired knowledge from healthcare expertise to the rural communities. The instruments were developed and survey was conducted in rural area of Baling, Kedah. 435 questionnaires have been distributed and only 245 are qualified to be analyzed using quantitative analysis. The result shows that the rural communities are appreciate and long-wait with this new type of technology in helping them to improve the healthcare rural system even though the wireless infrastructure is hindering.

Keywords: Knowledge management, knowledge transfer, rural ICT, wireless healthcare system.

I   INTRODUCTION

In March 2010, Malaysian government has initiated a national broadband strategy (MCMC, 2010) to ensure that every Malaysian citizen including rural communities can be reached by using the Internet access. In addition, community can be served better by the government especially in healthcare system by providing a platform between medical professionals (medical officers and other medical practitioners) and community in transferring healthcare knowledge. Wireless healthcare application is a one of solutions to enable the use of ICT such as computers, smart phones, Personnel Digital Assistance (PDA) and others devices which are connected with unwired internet services for accessing healthcare services and information.

Various wireless healthcare applications are developed and currently still in developing stage for the purpose of healthcare improvements. For instances, Mobil health is a project based on a European initiative to create a generic platform for home healthcare using Body Area Network based sensors and wireless telephony technology. This project would increase mobility and out of hospital care and monitoring (Halteren et al., 2004). Another project namely CONNECT is basically developed for creating solutions to help disable people in getting healthcare services. This application enables them to customize their portable devices such as PDA to keep schedules for them, receive important reminders and allow them to communicate with their caregivers using PDA.

Even though, there are many health centers (*klinik desa and klinik kesihatan*) available in rural area around Malaysia, yet the provided healthcare facilities require more improvement in facilities provided particularly on accessing the expert medical or physicians services importantly. Problem becomes worst since insufficiency of trained medical professional or physicians to the ratio of the existing population of a rural area. In fact, most physicians are not prepared to be placed in rural. There is a trend to doctors in Malaysia who are reluctant to serve in Malaysia after they graduated (Sahak, 2010) particularly in rural area. Various factors contribute to this issue such as the geographical barrier, and lack of financial entitlements to services among poor population, which not attract the physicians.

This paper discussed on the readiness of the rural communities in accepting a new approach for the effective transfer of acquired knowledge from expertise of healthcare to the rural area communities without geographical barrier. A wireless healthcare application as a new mechanism is intended as a new platform for enabling the knowledge transfer between medical professionals and patient in the rural area.

This paper is organized as follows: Section II describes on knowledge transfer in rural areas, Section III explains the methodology of the survey that has been conducted in this study. Result and findings of the study are presented and justified in Section IV. Conclusion and future works are described in the final section.

II   KNOWLEDGE TRANSFER ON RURAL WIRELESS HEALTHCARE

A. Knowledge Transfer Model

Nonaka and Takeuchi (1995) proposed four knowledge generation modes; Socialization, Externalization, Combination, and Internalization which is known as SECI model for transferring knowledge from expert to novice. It involves interaction and transaction between the tacit and explicit knowledge. The model is implemented in industries. In supports of the organizational goals, the processes in the SECI Model are combined in managing the within-organization knowledge. Socialization refers to the transfer of the tacit knowledge and experience through social interaction such as informal meetings, dialogues, and living together. This knowledge transfer model can be illustrated as in shown in Figure 1.
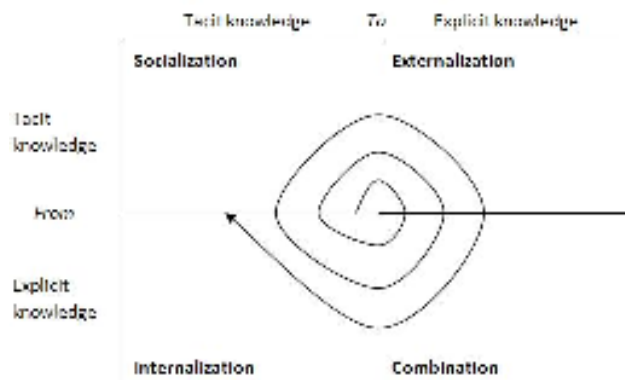

Figure 1. Proposed Tacit Knowledge Model on Rural Healthcare (adopted Nonaka, 1995).

According to Nonaka and Takeuchi (1995), socialization refers to the sharing of knowledge which creates the tacit knowledge such as the sharing of mental model and technical skills. Meanwhile, externalization refers to the processes of representing the tacit knowledge in writing formats or the explicit knowledge in any form of raw data so that they could be shared as the basis for new knowledge. Combination refers to the process of transforming the raw explicit knowledge into a group of complex and systematic explicit knowledge. In the internalization process, the gathered experiences in earlier processes are transformed into valuable values in views of the individuals and the organization. The cycle in the SECI model depicts the dissemination of knowledge among individuals and further the knowledge is expanded by other individuals in a dynamic knowledge creation environment. In particular, the dynamic knowledge creation begins when new knowledge created through a complete knowledge creation process functions as the basis for the creation of other new knowledge, and the basic knowledge grows gradually to higher levels (Nissen, 2006). In relation, Bhatt (2000) states that the transformation of self-created knowledge needs continuous knowledge flow within individuals. Hence, knowledge transformation should stress on the importance of interaction and transaction among the tacit and explicit knowledge dynamically and consistently.

B. Knowledge Management in Healthcare

Work from (Burnett, Williams, & Webster, 2005) define some relationship of information flow between healthcare professional with other organization. Collaboration, knowledge sharing and information exchanging of knowledge among the health service staff through inter-discipline knowledge base model. This work they defined it as managed clinical networks model. Normally, healthcare knowledge is stored is large knowledge base repository and using intelligent techniques (O'Sullivan, et al., 2007; Obenshain, 2004) such as case based reasoning, and decision support system. This clearly shows how the knowledge can be shared amongst the healthcare professional, such as specialist, doctor, nurse, dietician, pharmacist, or other services staff.

Different geographical location plays significant impact to the use of the healthcare knowledge management as mentioned in (Lee, Goh, & Chua, 2010). Their study on different two different locations, North America and Asia-Pacific, and showed North America performed better in accessing, creating and transferring the knowledge.

The healthcare industry is increasingly becoming a knowledge-based community that required a connection several parties including medical professionals in hospitals and patients for sharing knowledge in improving the quality of healthcare (Bose, 2003). Thus the success of healthcare depends on the knowledge management solution by utilizing information or knowledge between medical professionals and patients. Indeed, knowledge management provides a mechanism for effective knowledge transfer in order to aid medical professionals dealing with patients (Dwivedi et al.,2002).

Unfortunately, the current issue is how to disseminate the healthcare information and knowledge particularly for patients who live in rural area. Thus, knowledge management is believed to be the current solution in healthcare environment due to pitfalls in providing a mechanism for the effective transfer of the acquired knowledge to the

rural area residents (Dwivedi et al., 2002; King et al., 2002). Knowledge management is more than the centralized repository healthcare data and information (Guptill, 2005). According to Hsia et al. (2006), knowledge management involves four cyclic process namely knowledge creation, knowledge codification, knowledge transfer, and knowledge application. Knowledge creation involves in the process of acquisition and development of knowledge. Then, the knowledge is converted into accessible and applicable content during knowledge codification. After that, the knowledge is transferred from the source of creation to the point for applying the knowledge. Knowledge transfer is also obtained by adapting several cyclic activities; mobilizing knowledge, knowledge searching, knowledge distributing, knowledge sharing, and knowledge pulling and pushing. At the last stage, the knowledge is retrieved and applied for implementation of actions, decisions, or problem-solving.

Knowledge transfer is the important part of knowledge management and promotes the knowledge transmission among individuals in community or organization. Guptill (2005) defined that there are five main knowledge transfers in healthcare application namely a) communities of practice, b) content management, c) knowledge and capability transfer, d) performance results tracking; and e) technology and support infrastructure.

We conclude that knowledge management encompasses the social context of others' experiences and knowledge gained in terms of communities of practice. Therefore, it is essential to incorporate the knowledge transfer concept among individuals in healthcare environment with a shared common purpose, or interest when discussing healthcare knowledge in order to ensure this knowledge could be transferred, used, and disseminated among healthcare community.

Contents management refers to a centralized knowledge library with various layers of healthcare information. It is required a thoughtful plan for determining the types of content to be published, levels of security access, publishing formats, and processes for ensuring that the healthcare content posted is accurate, up-to-date, and consistent. Developing a schedule for updating or refreshing the healthcare information is needed in knowledge transfer.

In terms of knowledge and capability transfer, knowledge transfer enhances patient care. Knowledge transfer is related to idea of skills or capability transfer, including the behavior or attitude in willingness to transfer the required

healthcare knowledge. In order to improve knowledge transfer in healthcare environment, a rigorous results tracking capability incorporated is needed. The measurement can be done in terms of outcomes, processes and satisfactions of expert medicals or patients towards the knowledge transfer facilities by using surveys or others measurement technique. Ultimately, technology and infrastructure are vital to enable knowledge transfer activities in healthcare environment such as telemedicine, tele-health, and wireless application. Thus, this study is mainly investigating the tacit knowledge transfer amongst medical professionals and rural community on healthcare information.

III   METHODOLOGY

Data were collected through a survey (survey research design) based on Cohen, Manion, and Marrison (2000), Lavrakas (2008), and Stewart (2002). In theoretical study phase, reviews of literatures are carried out to gather information related to this study. The factors of SECI processes in the context of healthcare have been examined. The purpose of this study is to investigate the knowledge transfer process from medical professional to patient in rural area. The instrument is developed based on these factors. It consists of requirement of wireless healthcare application and SECI processes between medical professionals and patients. Pre-test study was conducted to validate the instrument which is divided into two stages, face validity and content validity. The instrument is refined based on the responses in a pre-test study. After refinement, pilot study is conducted in the selected rural area. The internal consistency is conducted based on the data in the pilot study. The Cronbach Alpha value for the instrument was 0.77, which is reliable because it is greater than the threshold value 0.6 (Nunnally, 1978). This implicates that the instrument is reliable and good at asking what it should ask. Then the instrument was updated as suggested by the respondents in terms of terminologies.

Data were gathered in a selected rural area, Baling, Kedah as suggested by medical professional/expert domain which then was analyzed using descriptive analysis. Descriptive statistics are used to explain on the information of the collected data in the study including mean, standard deviation and frequencies (Sekaran & Bougie, 2009). Sampling technique used in this study is a convenience sampling. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher (Sakaran & Bougie,

2009). This was done by making attempts to get the respondents to fill out the survey in various health centers in Pekan Baling and Kupang, Kedah. Data for the study is collected manually from the respondents using set of questionnaires. The collected data have been analyzed using statistical technique software, SPSS version 19.

A set of questionnaires was constructed by adapting from Merza & Mazida (2007) and Nonaka& Takeuchi (1995) in the healthcare context. The investigated factors in study are Socialization, Externalization, Combination and Internalization of managing patients' healthcare. The questionnaires is measured using likert scale 1 to 5, in which 1 is for strongly disagree and 5 for strongly agree.

The validity of content of the instrument has been revised to number of domain experts including the medical practitioners, and expert review. Considering their recommendations, a small modification and adjustment had been made involving rewording, sentence rephrasing, and item renumbering. However, due to time constraint, researchers only received minimal response from the domain experts. Therefore, we decided to conduct a pilot test to further validate the content validity of the instrument.

A pre-test study was conducted by two groups; three faculty members for face validity and 5 survey questions to medical staffs including doctors, medical assistants and nurses for content validity. The face validity involved comments and suggestions regarding the wordings, clarity, structure, consistency and the length of the questionnaire that should be incorporated in the survey.

Data have been collected in a few areas of Baling including Pekan Baling and Kupang. The target respondents were in the health centers *(klinik desa and klinik kesihatan).* 435 questionnaires have been distributed to respondents and only 245 are reliable to be analyzed after rejecting all missing data from some of the returned questionnaires. There are many approaches in determining the total number of sample size including a census for small populations, sample based on similar study, and sample size based on calculated formulas formulated (Israel, 2009). In this study, minimum total number of sample size that has been suggested is 204 (Israel, 2009). While our cleaned respondents is 245 with precision of ±7% and confidence level 95% and p=.5.

Analyzed data are discussed in the following section. Summarized demography of the collected data is presented in Table 1.

Table 1. Summarization of Data Demography.

Subject	Total (%)
Gender	
Male	53.5
Female	44.9
Ethic Group	
Malay	90.2
Chinese	4.1
Indian	1.2
Other	1.2
Highest Education	
No formal Education	3.3
Primary School	11.8
Secondary School	67.8
Certificate	6.1
Diploma	5.3
Degree	5.7

IV   RESULT AND DISCUSSION

A. Results

Validate of the data, the Cronbach Alpha was analyzed. Besides, the skewness and kurtosis were also tested to analyze the normality distribution of data. The values for both Cronbach Alpha, and skewness and kurtosis are discussed separately for each indicator of the constructs. In this study, the exploratory factor analysis (EFA) was not carried out because the constructs and indicators are based on a theory (SECI model).Meanwhile, the EFA was utilized to identify the variables in each construct in which the construct was determined through actor analysis. It could be seen that the skewness and kurtosis values are within the range that explains the data are sufficiently located within the acceptable normality. In detail, the acceptable values for skewness are 3 or less, while values 8 or less for kurtosis are acceptable (Kline, 2005). Summary of the data skewness, kurtosis, mean and standard deviation (SD) values as shown in Table 2. In this case, overall Cronbach Alpha is 0.7.

B. Discussion

The study found that respondents prefer face to face discussion with medical professional. (M = 4.23, SD = 1.09). However most of the respondents do not refer to other medical professional for the second opinion (M = 2.74, SD = 1.4). They also rarely communicate with medical professional through online application (M = 1.71, SD = 1.11). In general, the overall mean for this process is moderate (M =2.89, SD = 1.2). Respondents prefer to interact face to face with medical professional regarding their healthcare information.

Table 2. Items Skewness, Kurtosis, mean and SD.

Item	Skewness	Kurtosis	Mean	SD
Socialization				
SOC1	-1.535	1.657	4.23	1.09
SOC2	.187	-1.225	2.74	1.40
SOC2	1.713	2.130	1.71	1.11
Average			2.89	1.20
Externalization				
EXT1	-.055	-1.402	3.04	1.47
EXT2	.918	-.501	2.09	1.33
Average			2.57	1.40
Combination				
COM1	-.464	-1.144	3.42	1.43
COM2	-.333	-1.279	3.22	1.46
COM3	.847	-.764	2.17	1.44
Average			2.94	1.44
Internalisation				
INT1	-.460	-1.118	3.42	1.42
INT2	-1.098	.076	3.94	1.29
INT3	-1.464	1.651	4.17	1.07
INT4	-1.541	1.405	4.18	1.19
Average			3.93	1.24

**Cronbach Alpha for the whole item is 0.7

Respondent also prefer direct interaction between medical professional in transferring knowledge in term of healthcare information to the respondent compared to referring to other medical staffs for second opinion about their healthcare information. There is also lack of opportunity to communicate with medical professional via online medium because the availability of this application/medium is low.

Respondents feel that medical professionals do not provide health information into understandable forms such as relevant drawing or photos (M = 3.04, SD= 1.47). They also barely articulate explanation given to form or figure for their health (M = 2.09, SD= 1.33).). Overall mean for this process is moderate (M =2.57, SD = 1.4). Respondents believed that medical professional favor on disseminating knowledge verbally mainly face to face discussion with patient in contrast to information in written document for future references. Respondents explicitly are not favored on text or number type of information from medical professional of their healthcare information. At least, online medium/application knowledge transfer from medical professional to patient concentrate on socialization process and this tacit knowledge form. With the existence of online medium/application, each discussion is stored in type of written document that can be deposited in knowledge repository as reference and guidance.

In combination process, most of the respondents depend on other people including family members and neighbor to monitor their healthcare (M = 3.42, SD=1.43). In addition, they feel extra healthcare reading could increase their knowledge on the healthcare (M = 3.22, SD= 1.46). Nonetheless, accessing the Internet for healthcare information is poor amongst respondents (M =2.17,SD=1.44). Research found that development of comprehensive and systematic healthcare information is vital. Based on the data, it shows that respondents have initiative to gather information from various resources such as family and reading materials such as books and magazine. However, deficiency of accessing Internet for extra healthcare from the respondents is as a result of to the shortage suitable online medium/application for their needs.

The respondents make their own decision towards healthcare information (M = 3.42, SD = 1.42). They also agreed that healthcare advertorial or announcement benefited for their healthcare (M = 3.94, SD = 1.29). They are highly positive in handling their healthcare (M = 4.17, SD = 1.07) and concern about their healthcare level (M =, 4.18 SD = 1.19). Based on full interaction with medical professionals and references from other online medium/application resources, it helps respondents to understand and handle their own healthcare situation. Overall, direct interaction between medical professional and patient contribute in transferring knowledge from expert to novice. However, with the existence of each externalization process on information, it help the patient to have additional references and assists medical professionals in decision making on relevant healthcare information.

V   CONCLUSION AND FUTURE WORKS

In general, with a strong social interaction between expert (medical professionals) and novice (patient), good crystallizing process of expert knowledge to be explicit knowledge, combining various sources for related healthcare information, patient will internalize the healthcare knowledge in handling their healthcare condition. For medical professionals, the explicit knowledge can be used as decision support and medical references. Each process in SECI model should be highly considered in succeeding the knowledge transfer process so that the expert and novice tacit knowledge could be upgraded.

There is countless opportunity of the wireless applications for healthcare information in Malaysian that match the rural requirements. Online consultation is one of the main applications where

rural community can get medical professional advices or consultations on relevant healthcare's necessities. Our research reveals that at the moment, online consultation via online interaction is one of the applications by using email or forum discussion in some health related websites. Still, many potential applications have not been explored yet in Malaysian rural healthcare system. And this preliminary work would led us to future research.

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