Teleconsultation as Knowledge Management System: Recognizing the Issues Contributing to Its Underutilization in Hospitals

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Abstract— Teleconsultation offers a platform for remote medical care. However, they have been concerns about the poor acceptance rate towards the initiative resulting in the facility being underutilized. Studies often look at the use of teleconsultation from the perspectives of technology acceptance, in many cases forgetting the fact that it is also contributing greatly towards knowledge building and preserving within healthcare organization, offering a wealth of knowledge and expertise development opportunities. This study is looking at teleconsultation use from the perspectives of knowledge management, starting by confirming that it is of type KMS, studying how it fits in healthcare's knowledge exchange landscape and then establishing the determinants and inhibitors for the system's use among medical practitioners. Existing research on the use of teleconsultation are studied to determine the aspects influencing its success and the finding is hoped to pave the way for further studies on teleconsultation success in health care organizations from KM perspectives.

Keywords— teleconsultation; medical practitioners; knowledge management systems; knowledge exchange

I. INTRODUCTION

Teleconsultation provides opportunities for medical care across the globe. The population of the underserved areas can now receive specialized health care from a distance. With teleconsultation, doctors at the local hospitals are able to communicate and escalate medical cases that require specialists' attention. Despite the known advantages of teleconsultation, there have been concerns about the poor acceptance towards the initiative. This has been discussed widely for some time and the studies have often looked at the use of teleconsultation from the perspectives of technology acceptance among users, in many cases overlooking the fact that teleconsultation is also contributing greatly towards knowledge building and preserving within healthcare organization, where it offers a wealth of knowledge and expertise development opportunities. This study is looking at

teleconsultation use from the perspectives of knowledge management, first by confirming that it is indeed a KMS, looking at how it fits in healthcare knowledge exchange scenario and follows by identifying the determinants and inhibitors for its use among medical practitioners. Literatures on teleconsultation are studied to determine the aspects influencing its success and the finding is hoped to offer grounds for further studies on teleconsultation success in health care organizations from KM perspectives.

II. LITERATURE REVIEW

Studies have recognized the advantages of Teleconsultation in health care practices worldwide. [1], [2], [3], [4], [5]. While the initial objective of teleconsultation is to provide remote medical attention services via the use of IT to the underserved regions [2], [3], [6], [1], [7], the actual activities taking place during teleconsultation, especially between doctors, suggested that there is a high concentration of knowledge-based activities involved where doctors are using teleconsultation to seek, exchange, build and store medical expertise. [8], [3], [1]. Hence, the benefits of teleconsultation can equally be recognized from the perspectives of knowledge management, where the system serves to aid the handling of healthcare organizations' intellectual properties.

Though teleconsultation is fast securing a prominent place in healthcare, the fact remains that its adoption worldwide has not been very encouraging. World Health Organization's survey in 2010 Global Observatory for eHealth series [9] has established only 20% of the responding countries conducted review and evaluation on their telemedicine. While the latest report in 2016 [7] has shown a slight increase of 24% for review and evaluation, the low figures remain as an indication that telemedicine may not be regarded as very important which has led to the possibility that the system is being underutilized. In addition to that, the acceptance rate for telemedicine among participating countries stood at only 64% [7], a figure suggesting acceptance issues among the users.

In Malaysia, the use of telemedicine through teleconsultation had seen a lukewarm reception during its early deployment in 2007 with only 53% hospitals implementing teleconsultation facilities [2]. In the UK, North Yorkshire and

York Primary Care Trust investment of £3.2 million for teleconsultation use in primary care has only resulted a usage of 20 out of 90 general practices, and clinicians' attitude towards teleconsultation has been blamed for this. [10]. Similarly, a study on Brazilian teleconsultation service has also reported a decline in utilization from 1600 utilization per month in the year 2011-2012 to 700 utilization per month in 2013-2014 [11]. This poor acceptance and adoption in return has put a big challenge in realizing teleconsultation's potentials where knowledge exchange is concerned.

In addressing the many factors contributing to the success of teleconsultation implementation, existing researchers have been found to primarily concentrate on technological acceptance among the users. [3], [12], [13]. Teleconsultation in healthcare is often regarded simply as an Information Technology undertaking even though it is clear that activities involved during teleconsultation have suggested that the system is indeed a KMS. Thus far, user and technology acceptance-based models such as TAM [3], [14], [15], UTAUT [16], [17], [18] and FITT [19], are used in deliberating the implementation of teleconsultation systems. There have been limited referral of teleconsultation as a KMS in existing studies, resulting in the limited consideration on KMS based frameworks in the discussion of teleconsultation implementation. The findings of this study are hoped to provide understanding on the aspects that influence the doctors' inclination to use teleconsultation for knowledge exchange.

III. METHODOLOGY

Studies on literatures pertaining to the context of this investigation are conducted. The authors have put a focus on understanding Teleconsultation from the view point of Telehealth, confirming it to be of type KMS and identify issues contributing to its poor utilization. The summary of the findings is discussed in the following subsections:

A. Teleconsultation

Teleconsultation has been identified as a type of telemedicine presenting "communicational and interaction platform between two or more health care professionals" [20]. It is known as a provision that provides a remote medical consultation to patients, filling in the gaps for the patients who are physically located far away from medical services or not in a position to make the trip down to receive treatment [21], [22], [20]. It is also used as means by doctors to seek advice or second opinions from other experts who are not residing in the same hospital on difficult medical cases [5], [3]. In general, teleconsultation is one of the facilities that comes under the umbrella of telemedicine, and telemedicine is indeed a subset of telehealth as illustrated in Figure 1.

It is significant to be able to establish the underlying concept of teleconsultation pertaining to which part of healthcare system it belongs to as this helps to identify the activities, people and technology involved in the process. This knowledge will come in handy in mapping the facility to the correct category of Information Systems, enabling clear understanding of the implementation requirement and sub
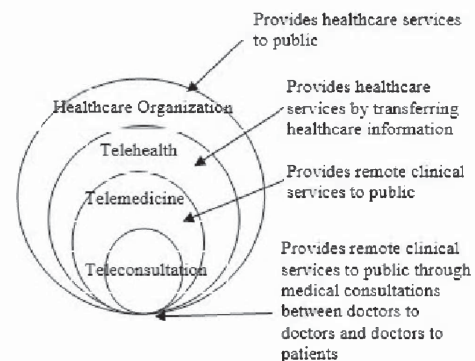

Fig. 1. The Telehealth, Telemedicine and Teleconsultation Association

sequentially steering the research based on the theoretical foundation relevant to findings.

A subdivision of telemedicine, teleconsultation is also known to be one of the emerging technologies in healthcare today. [3], [23]. Among the teleconsultation initiatives that are already in place in healthcare are telecardiology for remote heart patients in the Malaysia [24], France's telemedicine supported geriatrics hospital [5], private online medical service for an oil and gas organization in Iran [25], telemedical for emergency health services in Germany [26], telerehabilitation in a Canadian rehabilitation center [22], US military tele-orthopedic for warzone patients [27] and the list goes on. Examples of current teleconsultation services worldwide is presented in Table 1.

TABLE I.   EXAMPLES OF TELECONSULTATION SERVICES WORLDWIDE

Study	Country	Teleconsultation System	Tools Used
Esterle et.al. (2013)	France	Telegria Geriatric Care	Emails, hospital network, dermathoscope, stethoscope, ultrasound, electrocardiograph and stethoscope
Luk (2008)	Ghana	General Health Care	Emails, hospital network
Lehoux (2002)	Canada	General Health Care	Emails, hospital network
Singh (2011)	Malaysia	Telecardiology Teleradiology Teleneurosurgery Teledermathology	Webcam, Film Digitzer, high resolution monitor, hospital network, printer
Chapman et.al (2010)	Sri Lanka	General Health, ViduSawa Electronic Healing System	Webcam, hospital network, emails
Hojabri et.al (2013)	Iran	Private Online Health Care for Iran's oil and gas company	Webcam, hospital network, emails
Kairy et.al (2014)	Canada	Telerehabilition	Emails, hospital network
Waterman et.al (2014)	USA/ The Gulf	Teleorthopaedic Global Military Orthopaedic (USA)	Emails, hospital network

From the list, it is apparent that there is a wide range of communication, imaging and printing technologies which have been utilized to enable teleconsultation in healthcare. Health care organizations have acknowledged teleconsultation strengths, not only at delivering healthcare to those who are living away from the specialist hospitals but also recognizing the benefit from the perspectives of being an excellent platform for knowledge exchange and clinical proficiency development among doctors [4], [5] by creating 'valuable learning opportunities for the referring physicians', which is much more substantial comparing to manually referring to a complex handbook [21].

B. Teleconsultation as Knowledge Management System

Hospitals use information for two main reasons. One is to support the daily business process where data and information are recorded and used to manage hospitals' operational and strategic needs. [28]. Another purpose of information in healthcare is to assist knowledge-based activities between doctors in performing their jobs to deliver medical attention to the patients. The norm of medical practitioners' duties has called for them to not only practise the knowledge they have studied during their training but also to extensively build their clinical skills while being on the job. It is a routine for doctors to gather information from the patients to help with diagnosis. In the process they may also refer to the specialists or other doctors to help them in making decision about the health condition of the patients to determine the next course of action. There are great possibilities that new level of expertise will be developed each time new medical conditions are presented.

From organizational viewpoints, knowledge is considered an asset and it is important that knowledge remains in the business [29]. In hospitals, the knowledge exchanged between the doctors, if recorded well, will be very useful as it can be referred to by other doctors to deliver more efficient healthcare services, where shorter time and more accurate diagnosis and prognosis can be given to patients

Teleconsultation can be an effective communication tool in providing the means for knowledge exchange activities between doctors [3], [6], [23]. The common practice for doctors under teleconsultation setup will include the specialists providing remote diagnosis to the medical cases which are presented by the less skilled doctors who may need a specialist to refer to. The use of KMS is evidently useful among doctors due to the knowledge-based activities involved. [30]

To confirm that teleconsultation can be categorized as a KMS, Nonaka's [31] list of KM activities has been mapped to teleconsultation activities and has been found to demonstrate all of Nonaka's KM activities where knowledge is "created, codified, transferred and applied" as shown in Table 2. To further demonstrate the existence of KM activities in teleconsultation, a list of knowledge activities derived from established KM research by Nonaka [31], Alavi [29], Gartner Group [32] and Wiig [33] are mapped against teleconsultation activities in Table 3. These two findings confirmed that teleconsultation is a knowledge intensive exercise and is qualified to be categorized as KMS. Future studies on the implementation of teleconsultation in healthcare can indeed be

undertaken from the perspectives of Knowledge Management. In addition, these findings have suggested that knowledge exchange activity to be the main knowledge activity during teleconsultation, appearing prominently throughout the process.

TABLE II.   MAPPING TELECONSULTATION TO NONAKA'S KM ACTIVITIES

Types	General Function	Players	KM Activities with the goal of managing the knowledge of employees to be used by other employees as assets for the organization (Nonaka, 1991)			
			Creation	Codification	Transfer	Application
Traditional Telemedicine	Patients will receive an online consultancy service while being in a local hospital. The consultation will be provided remotely by a specialist. Local doctors may present with the patient	Patients Specialists Local Doctors	✓	✓	✓	✓
Physician-To-Physician Consultation	Consultation between medical practitioners without patients being physically present	Specialists Local Doctors	✓	✓	✓	✓

Though there are two categories of medical consultation in hospitals; one being consultation between doctors and patients and the other being consultation between doctors and doctors, this study is focusing on the later type as it involves more opportunities for knowledge exchange and skills development among doctors. Saliba 's [34] telemedicine systematic review has established that 87 out of 94 literatures being referred to were discussing knowledge-based activities between medical practitioners, which suggests significant knowledge management activities through the use of telemedicine between doctors.

C. Issues Contributing to Teleconsultation Utilization

In general, teleconsultation, though has been way exceeding its infancy period, is still in need of a certain pushing factor for not only acceptance, but most importantly, adoption among the medical practitioners. Rho et al [35] asserted that resistance from the principle users of teleconsultation, namely the medical practitioners is a norm in implementation of additional Information Systems in

healthcare organization. This is in line with Ahn's [36] take on the slow progress of telemedicine in Korea which is resulted from physician's resistance on telemedicine act. Esterle [5] has highlighted that doctors are being reluctant fearing it will interfere with their medical duties and adding more to the workload. Studies to date have suggested the explanation for teleconsultation underutilization is largely attributed to doctors' lack of willingness in embarking on this not very traditional way of providing medical care. [37], [8], [3], [5].

Generally, in any introduction of technology to a business process, employees may feel unsure about their technical ability to use the system [38]. In the exchange of knowledge, some doctors are worry that the knowledge they share may not be conveyed well [21]. Socially, doctors may be influenced by what their peers think of them if they were to use the system. Some may be worried that their competency is to be questioned if they resort to seeking consultancy from their peers [21], [5].

In relation to users' attitudes towards using teleconsultation, studies have also highlighted the importance of organization direction and commitment in setting the path for a successful teleconsultation use as well as in ensuring the infrastructure [39], guidelines and protocols of the system are in place [18], [40], [41]. This is in line with the findings established for the studies conducted to investigate KMS implementation success in other industries [29], [42].

From the study of literatures on factors leading to teleconsultation underutilization, it is evident that doctors' mindset towards technology is largely influenced by systems, organization, individual and social factors. [21], [22], [5], [34], [3].

IV. RESULTS AND DISCUSSION

Unwillingness to adopt teleconsultation among the medical practitioners will result in not only waste of resources and poor return of investment in realizing the remote medical care initiative, but also the likelihood of poor knowledge exchange between doctors in what supposed to be an information rich environment. This especially, will lead to a risk of losing valuable knowledge and expertise which have been accrued between doctors during the handling of the many medical cases over the years. It is fair to conclude, while doctors are buried deep in knowledge rich environment each time they consult one another, there are significant risks of failure in preserving the knowledge that has been exchanged if KMS, in this study, Teleconsultation, is not being utilized.

The literatures have suggested doctors' reluctance in making use of the Teleconsultation system to perform their duties is due to many factors such as the quality of the system, the quality of the information being exchanged, trust issues, unfamiliarity issue with the system as well as the counterparts they are supposed to deal with and also the extra workload undertaking Teleconsultation will cause them. To gain better perspectives on the issues contributing to teleconsultation underutilization, a summary of potential constraints is illustrated in Figure 2 and a compilation has been made consisting of the issues and factors influencing the underutilization of teleconsultation in Table 4 as established from the literature's studies

TABLE III.   MAPPING THE KM ACTIVITIES TO THE TELECONSULTATION ACTIVITIES

| Steps in Teleconsultation Usage	KM Activities (Nonaka, 1991)	KM Activities (Alavi, 2001)	KM Activities (Wiig, 1993)	KM Activities (Gartner Group, 1991)
Inhouse Assessment and Information Gathering Medical practitioner assesses patients and prepares documents/material on patients condition to be shared with the specialist Participants : Medical practitioners and patient Type of knowledge : Tacit, Explicit	Knowledge Creation Knowledge Codification	Creating internal knowledge	Building Knowledge Holding Knowledge	Identifying knowledge Capturing Knowledge
Acquiring Knowledge Medical practitioner initiate consultation with the specialist Participants: Medical practitioner and specialist Type of knowledge : Tacit	N/A	Acquiring external knowledge	N/A	Retrieving knowledge
Transfer of Medical Documents Medical practitioner shares documents/material on patients condition with the specialist Participants: Medical practitioner and specialist Type of knowledge : Explicit	Knowledge Transfer	Sharing knowledge	Pooling Knowledge	Sharing Knowledge
Assessment of Information Specialist assesses the condition based on the knowledge provided by the medical practitioner Participants: Specialist Type of knowledge : Explicit	Knowledge Creation/ Application	Creating internal knowledge	Building /Apply Knowledge	Retrieving knowledge
Provide Consultation Specialist provides the advice and imparts knowledge based on his experience, expertise and information at hand Participants: Specialist and medical practitioner Type of knowledge : Tacit, Explicit	Knowledge Codification Knowledge Transfer	Sharing knowledge externally	Holding Knowledge Pooling Knowledge	Sharing/Capturing Knowledge
Apply knowledge Medical practitioner acts based on the advice received from the specialist Participants: Medical practitioner Type of knowledge : Tacit, Explicit	Knowledge Application	Updating knowledge	Building Knowledge Apply Knowledge	Capturing knowledge
Record Knowledge Medical practitioner records the consultation process and store in the system Participants: Medical practitioner Type of knowledge: Explicit	Knowledge Codification/ Transfer	Storing knowledge	Holding/ Pooling Knowledge	Capturing Knowledge
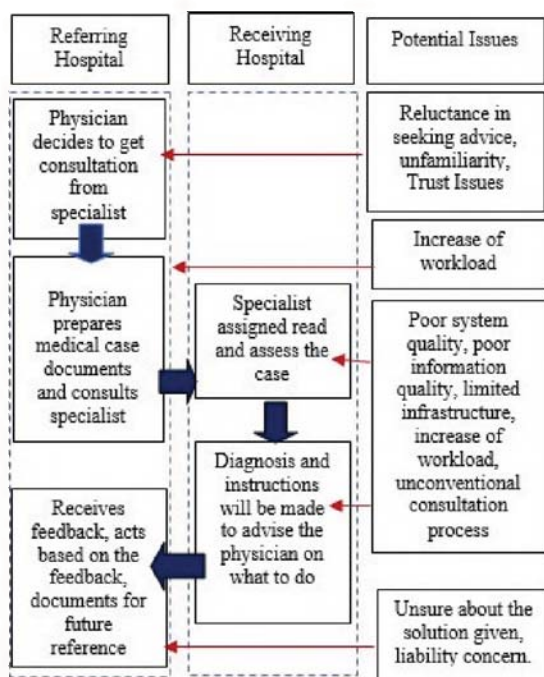
Fig. 2. A summary of constraints to each stage of teleconsultation process

TABLE IV.   LIST OF ISSUES CONTRIBUTING TO TELECONSULTATION
UNDERUTILIZATION

Study	Location	Type of teleconsultation	Reasons for poor utilization among medical practitioners
Esterle et.al. (2013)	France	Geriatric Care	Delay in duties and additional workload due to having to work with doctors from different physical locations Doctors may feel intimidated having to deal with other personnel they are not familiar with. Doctors are unable to conduct direct clinical examination leading to process uncertainty
Luk (2008)	Ghana	General health care	Unreliable telecommunication and infrastructure in coordinating and consulting with colleagues
Lehoux (2002)	Canada	General health care	The system does not fully support the medical consultation tasks involved.
Alajmi et. al (2015)	Kuwait	Assorted HIS applications for medical consultation	Doctors prefer not to use knowledge sharing tools and recording tools during medical consultation process.
Khan et.al (2016)	USA	Assorted telemedicine usage in hospitals	Doctors have highlighted concerns over legislation and limited precedent regarding liability issues
Maarop (2013)	Malaysia	Assorted telemedicine usage in hospitals	Lack of protocols and guidelines and short supply of technical supports have discouraged the usage

V. CONCLUSION

The use of teleconsultation for knowledge exchange among medical practitioners have been identified in this study as one of the means for health care organization to preserve valuable medical knowledge for the benefits of medical practitioners' expertise development. Teleconsultation cannot be a successful initiative for knowledge exchange in healthcare if doctors are unwilling to use the system.

Therefore, to ensure that teleconsultation is used to its full potential, it is important that supporting and inhibiting factors are identified and an outline for a successful implementation is put in place. Since teleconsultation has been categorized as KMS and KMS is identified as Information Systems, this study will be referring to existing KMS success models that have been developed based on IS related frameworks.

Based on the identification of the teleconsultation underutilization issues, this study can proceed to establish constructs for a teleconsultation success and next integrate them into a form of a KMS success model. The model will be validated by medical practitioners from the Malaysia's public hospital who are using teleconsultation system. The model development and validation will be discussed in a separate publication write up.

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