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Teleconsultation technology and its benefits: In the case of public hospitals in Malaysia

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The ultimate objectives of this study are to describe teleconsultation activities and explore the benefits of teleconsultation technology in the context of public health care environment in Malaysia. The materials of this study were based on an exploratory mixed method studies involving semi-structured interviews with key informants and questionnaires survey of health care providers to obtain information about existing teleconsultation activities as well as to uncover the benefits of teleconsultation technology. The notable benefits from teleconsultation implementation were further discussed. The findings confirmed that teleconsultation service has improved health care delivery in the underserved areas to consult with specialist. One of the important insights gained from this study was that the store-and-forward teleconsultation was found acceptably feasible and have provided great assistance in the emergency setting. Overall, the results of this study can be used to promote teleconsultation as an effective means in delivering better health services. In respect to theoretical development and future work, the categories that were generated from these studies may be used for the development of perceived benefits and usefulness measurement tools in exploring acceptance and adoption of teleconsultation technology.

Keywords

Teleconsultation, Telemedicine, Benefits, Perceived Usefulness, and Hospital.

1. Introduction

Telemedicine is defined as the integration of Information telecommunication, human-machine interface technologies and health technologies to deliver healthcare, to promote the health status of the people and to create health (Mohan & Yaacob, 2004). Teleconsultation is one of the main components of telemedicine. Teleconsultation can be operated in either asynchronous store-and-forward (e.g. use of email and dedicated system) or synchronous mode by utilizing video

conferencing technology. Teleconsultation comprises broad collection of information and communication technologies (ICT) and serviced as part of health care facilities to deliver and manage long-distance clinical health services especially at the underserved areas to consult with specialists. A review of telemedicine revealed that many developing countries were introduced to telemedicine in late 1990s (Maarop & Win, 2009). Teleconsultation uses extensive Information and Communication Technology (ICT) and involves various stakeholders (e.g. administrative staff, physician, specialist, policy maker, telemedicine vendor, and ICT maintenance team). In Malaysia, this includes consultation and referral over electronic platform (web-based technology) which takes place between health care providers at primary (also secondary) and tertiary health care facilities. The potential utilization of telemedicine in developing nations are often seen equally important in both aspects of clinical and educational as those in industrialized countries (Wootton, 2008). The rapid advances in ICT have vastly increased the capacity and potentials of teleconsultation. In one glance, teleconsultation has made the services of specialists' consultation available throughout the hospitals' network. The objectives of this study are to discover the activities involved in teleconsultation process in the context of Malaysia and to explore possible benefits of teleconsultation technology.

2. Literature Review

Chau and Hu (2002) asserted that the likelihood of telemedicine adoption was mainly influenced by perceived usefulness and benefits of telemedicine technology among individual professional. Therefore it is of great importance to uncover potential evidence concerning telemedicine benefits in order to promote the use of the technology among health care provides. Hjelm (2005) envisaged that the advantages of using telemedicine system would improve provisional of care in the areas that were not previously deliverable, improve access to information, improve access to health services and reduce health care cost among others. Hence it could be postulated that one of the obvious benefits of telemedicine technology is that it would provide the unmet health care services need in the underserved areas to consult with specialist. There is a need for directive and consent from a specialist at tertiary hospital in order for a physician at primary hospital to perform any further medical procedures on patient and this can be obtained immediately over telemedicine. For example, guidance and direct supervision of trauma surgeon is needed to perform successful trauma resuscitation and this can be done when using telemedicine principles carefully (Latifi et al., 2005). One of the potential telemedicine benefits on the work of health professional is that it could provide easy access as well as facilitate communications among colleagues (Gagnon et al., 2006). One of the identified major benefits of telemedicine implementation in New Zealand is that it could reduce consumer's travel cost (Al-Qirim, 2007). Moreover according to economic analyses, Roine et al. (2001) suggested that telemedicine application that was based on transmission of CT images would lead to significant cost saving. Acceptance by clinicians, improved access to health care particularly in remote areas and avoidance of travel for either patients or health care providers among others, constitute success in telemedicine applications (Wootton & Herbert, 2001). Telemedicine should be noted as privilege since it provides platform for communication that could lead to better knowledge within primary care and improves the quality of treatment (Wootton, 1996). If telemedicine is properly used and implemented it can save two-thirds of patients from visiting a hospital outpatient clinic (Harno, 1999) and this in turn would produce significant cost savings (Jaatinen et al., 2002). In line with that, Beach et al. (2001) suggested that in some cases teleconsultation

would help to avoid transfer or onward referral. Based on the interviews with 30 respondents, Aas (2001) found that an organizational consequences of telemedicine would include improved coordination of care, sharing of experience, merger of organization independent of location, less travel by staff (and patients) and beneficial effect on the quality of care hence different skills and perspectives can be integrated in a multidisciplinary environment which can result in a broader total understanding of the problem solving in the diagnosis. The benefits of telemedicine were evident in the rural areas of Arkansas as there were positive changes in diagnosis and management (Bynum et al., 2006). Furthermore the use of modern information technology offers tremendous opportunities to reduce clinical errors as well as of great assistance to health care professionals in executing their task (Ammenwerth et al., 2003). Based on the literature studies, we conclude that telemedicine certainly could bring a number of benefits to participating hospitals and health care providers particularly if it is conducted in an ethical manner. In turn, all of these literatures are fundamental in justifying topics of concern that were used to ask both the key informants in the semi-structured interviews and survey respondents participated in this study. To the best of our knowledge, there was no similar study have yet been conducted in developing countries involving substantial empirical data and mixed method approach.

The scope of the research is limited in several respects:

- The study encompasses the benefits of teleconsultation from the perspectives of respective teleconsultation key informants and health care providers. Therefore organizational economic analysis and results of a randomized controlled trial of intervention are not available from this study.
- This research only encompasses teleconsultation activities in Ministry of Health (MOH) hospitals in Malaysia and does not include private hospitals because the provision of teleconsultation system under study does not cater private hospital.
- Due to time and budget constraint, the data collection are based on cross-sectional and not longitudinal.
- This study only involves a new store-and-forward teleconsultation which was implemented in January 2010. Therefore the potential and benefits of video-conferencing teleconsultation is not available from this study.

3. Methodology and Method

This study was based on phenomenology mixed method design and a one-phase approach (Creswell & Clark, 2007), in which the quantitative data were embedded into qualitative data and serviced as supplemental and triangulation evidence within the overall research design. The rationale for this approach was that quantitative data and subsequent appropriate analyses would provide a strong understanding to the overall interpretation of the results (Creswell & Clark, 2007). Therefore the main description of this study was based on the overall qualitative interpretation. In line with deductive research approach, the research began with literature reviews. For this reason, provisional start list or template prior to commencing field work was developed (Crabtree & Miller, 1999; Miles & Huberman, 1994). The template was derived from a review of literatures as discussed in previous sub-section. Subsequently, we conceptualized those potential benefits of teleconsultation as being split into 2 major attributes namely supportive and critical benefits as shown in Table 1. The start list served as the basis of interview

questions and their preliminary codes were used to sensitize additional issues related to the underlying study (Miles & Huberman, 1994).

Attribute	Categories
Supportive	Broaden specialist options; improved documentation; improved coordination; improved communication between doctor and consultant and improved referral process.
Critical	Increased specialist access for consent purpose; reduced employment of resources; reduced patient transfer from primary to tertiary hospital and reduced mortality.

Table 1: Start List Prior to Fieldwork

The research procedure started with preliminary study involving interviews with three key stakeholders. The issues were discussed briefly with them before the primary data collection was performed and this involved user of the system, teleconsultation project manager and teleconsultation system support staff. The data collection procedures for both methods took place concurrently between March 2010 and July 2010 within participating hospitals. Ethics approval and consents were firstly obtained before proceeding to data collection since this involved study of human behaviour in health care environment. Research ethics were approved by Institute for Health Behavioural Research (IHBR) MOH Malaysia, MOH Research and Ethics Committee (MREC) Malaysia and Economic Planning Unit (EPU) Malaysia. A key-informant approach was used for semi-structured interview as it was regarded advantageous to gather information effectively, to gain access to unobtainable information and to gain specific understanding and interpretation of the cultural information (Gilchrist & Williams, 1999). The interviews were held based on purposive sampling involving 28 key informants and convenience sampling was used for a survey among health care providers who worked in the participating hospitals. As the interviews were recorded and most of the participants responded in English, the tapes were transcribed as soon as the first interview was completed. The transcripts were checked iteratively against the audio tapes as to ensure accuracy in the transcription. Seventy-two respondents returned the completed survey and helped provide triangulation information.

4. Result

The findings reported in this study were based on the responses of the participants with the following profiles:

A. Interviews (N=28): 15 users of the system (sender and receiver) accounted for 54%; 5 champions of the technology accounted for 18% and 8 teleconsultation system administrators accounted for 28% of total participants.

B. Surveys (N=72): The survey was distributed to only existing users of the system and those personnel who have attended teleconsultation seminar and training to help describe the

categories of benefits using descriptive statistics and this involved 43.1% medical officers, 25% of specialists (consultants) and 31.9% of medical assistants and radiographers.

Of the 130 MOH hospitals across the country, only 38 hospitals were selected to be provided with the new teleconsultation technology. The data were collected during the stage when the new teleconsultation technology was recently upgraded in several existing participating hospitals and the installation was done in stages in other new adopting hospitals. Of 38, only 11 participating hospitals (accounted for 29% of total hospital population) participated in this study.

4.1 Teleconsultation Activities

In Malaysia, telemedicine project was launched as one of the national flagship applications in April 2000 aimed to virtually expand the clinical service and expertise to rural and remote areas thus to improve quality of national health care. The project run in pilot mode over a 30-month period commencing in 2000, linking 38 Ministry of Health (MOH) hospitals and health clinics across the country (mainly peninsular Malaysia). However at that point of time albeit its advantages, teleconsultation in Malaysia had not been embraced due to some implementation and adoption barriers and the implementation had gone through evolution of massive technological and infrastructure alteration and upgrades as to uphold the providers in promoting good health and preventing morbidity and mortality. Due to inconsistency in service needs and demand, sustainability of utilization has been an issue of concern. Consequently, the transfers of teleconsultation equipment from majority of sites to new identified sites were performed; this is because some sites were not active and therefore reallocation of the sites had to be carried out in tandem with the needs for the service (Ministry of Health Malaysia, 2007). In turn, the new teleconsultation was launched in early 2010 and the potential of the latest teleconsultation technology was gradually being realized and transpired. There are only four major disciplines involved in the implementation of teleconsultation in Malaysia and these are neurosurgery, cardiology, radiology and dermatology. With regards to this particular nation's context, the teleconsultation facility involves centralized application services and data repository which operates over a nation-wide private telehealth network. Teleconsultation activities entail the engagement between sending and receiving sites virtually communicating with each other. In Malaysia, the prime teleconsultation activities were found to be related with medical support involving image transfer and then followed up with consultation over the system or telephone. Most of these cases were based on the need for specialist consent to further manage the patient. Activities that were solely related with second opinion were very few reported. The examples of excerpts of teleconsultation activities between a specialist (receiver) and a medical officer (sender) are as the following:

"...Teleconsultation is actually used for preliminary diagnosis. For example in a neurosurgical case; Let say the patient is admitted to Hospital A and if there is a necessity for the case to be sent here (referral hospital) ... as a neurosurgeon, I will have a look at the case and see how severe is the patient based on the images and description sent by the referring doctor through the system ..."

(Specialist at neurosurgical department)

“..We need to get the quick reply and teleconsultation is used for this reason. We need to know whether the patient can be treated in the conservative management or need further intervention. If the specialist decided to classify it as a conservative management, we would manage the patient in this hospital by following the directive from the specialist. If the case needed further physical intervention by specialist we would send the patient to the referral hospital immediately. However, in either case we still need to have the consent from the specialist. Once we have the consent then only the case can be moved...” (Medical Officer at the sending site)

The major steps involved during teleconsultation store and-forward session are summarized as follows:

Step 1: The sender (medical officer or medical assistant at primary hospital who is in need to get access to specialist) needs to access the teleconsultation system with his or her specified login ID and password and then fill in the patient details together with the clinical inquiries to be sent to the receiving consultant at the tertiary hospital.

Step 2: If necessary in the case of radiology and neurosurgery, the X-Ray and CT scan film would need to be digitized and converted into DICOM format. Together with that, patient data and the image would be encrypted and sent over to the respective receiving health facility (secondary or tertiary hospital) via a secured Telehealth-Nationwide network.

Step 3: Subsequently, the receiving hospital would receive the CT scan image in the appropriate format (e.g. DICOM, PACS) and patient details are then decrypted. The receiver would log on to teleconsultation system with his/her dedicated password to access the files sent from the sender.

Step 4: Concurrently, the in charge medical officer who is on duty at the referral hospital would receive notification about the case that was sent. This is done through mobile alert. Depending on the urgency of the case, the specialist would be informed about the case thus attend the case.

Step 5: Depending on the type of cases, some cases require a DICOM or PACS viewer to accurately view the whole image. A follow-up call would be made to advice the sender about necessary treatment and directive about patient management which needs to be performed at the sending site. The necessary information would also be documented into the system and securely kept as consultation log history for follow-up or future reference purpose.

4.2 Teleconsultation Benefits

Applications of teleconsultation could definitely provide various benefits to health care providers, organizations and patients. The benefits and usefulness of teleconsultation have been recognized and subsequently were categorized as supportive and critical benefits. Supportive benefits are advantages associated with efficiency of technology to support consultation and referral activities whereas critical benefits are advantages associated with efficiency of technology to support hospital organization and health care providers to provide health services to patients under constrained resources and critical conditions. In terms of supportive benefits, most of the interview participants have come to consensus that the benefits were found in the form of: 1. it is a quick way to specialist access; 2. broaden specialist options; 3. improved

documentation; 4. improved coordination in patient management between two participating hospitals; 5. improved communication between doctor and consultant; and 6. improved learning process for the inexperienced doctors. The majority of key informants agreed that teleconsultation could provide a quick way to specialist access. For example:

“...whenever the sender sent a case, an indication message would be sent from teleconsultation system to receiver’s registered mobile phone and the receiver can view the case immediately...”

The receiver would know what time the case had been sent and they would be more aware of the incoming cases and would attend the case without further delay. Moreover, teleconsultation can quicken the process of image transfer and referral. For example:

“...we used to send X-ray image using ambulance just to get consent and opinion from specialist...but now it is much faster after we used the system...”

However, this also hugely depends on the condition of consulting specialist at the receiving site as well as the urgency of the case. If the specialists were busy for example attending fresh or walk-in cases at the tertiary ward they would not be available to immediately respond to teleconsultation case except for emergency case that requires urgent attention. The majority of key informants expressed that teleconsultation can broaden specialist options for fundamental diagnosis and second opinion. One said:

“...not necessarily the one who picks up the case will provide the consultation. He or she might forward it to other consultant and specialist in the same tertiary hospital for more opinions...”

Most of key informants agreed that teleconsultation could improve documentation as well as coordination of referral. In brief, teleconsultation would provide easy monitoring of documentation since the data being transferred would go straight into the system. Furthermore there was no need for primary hospital to send hardcopy to tertiary hospital and this could avoid lost and missing films. For example:

“...the effort to physically move the patient requires a massive coordination between referring and consulting hospitals. So... having the system has lessened the coordination issues...”

Teleconsultation could also improve communication between doctor and consultant as the consulting specialist could communicate with the sending site’s doctor thus this would also lead to a consistency in the management of the patient. For example:

“...once the case is received, a consulting specialist would instruct us (referring doctor) on what to do based on the image and document that he or she received through the system...”

Another advantage could be gained from teleconsultation implementation is that it would improve the learning process among young practitioner. This is really effective as long as that every single thing is documented in the system. A dermatologist said:

“...the idea of teleconsultation is to bring the service by dermatologist to the most remote area where physical access is difficult and to train young doctors who are sent to the periphery station to learn dermatology...”

In terms of critical benefits, we have identified the bases for needing the teleconsultation services among participating hospitals and these are outlined in the followings:

- Broaden specialist access as to obtain faster consent concerning directive on patient management instead of only to get specialist advice.
- Better utilization of resources such as tertiary bed (especially emergency bed), ambulance and reduction of travel times and cost of the providers, other staffs and patients.
- Reduction of mortality and morbidity especially in the emergency cases.
- Reduction of physical referrals from primary health centres to tertiary centres.

The presentation of interview findings for critical benefits is shown in Table 2. The result shows that teleconsultation was found acceptably feasible and has provided great assistance in both emergency and non-emergency settings. A questionnaire using a 7-Likert scale was employed to collect data from all categories mentioned in this study and served as triangulation of evidence to the qualitative findings. The purpose of embedding quantitative data in this study was to allow a better understanding of the phenomenon in the context under study. A summary of the measurement items and scores (mean and standard deviation (S.D)) on completed survey (N=72) are shown in Table 3.

Cronbach's alpha (α) was used to measure the reliability of the instrument items (Cronbach, 1970). As a result, the reliability of all instrument items associated with benefits of teleconsultation exhibited a high standardized $\alpha = 0.89$ on 11 items and this is an acceptable level of reliability ($\alpha > 0.70$). Overall, respondents reported a high level of teleconsultation benefits and the highest score was found on item 9 that exhibited teleconsultation could be a significant tool to save patient life and reduce mortality with the mean score of 6.58 and the lowest standard deviation (.496). Of 72 respondents, 51 (70.8 %) declared that they have at least once used the new teleconsultation system whereas another 21 (29.2%) declared that they have not used the system but have been made aware of it through teleconsultation seminar and training. The frequency analysis also revealed that 50% of the respondents were active users of the system since they have made or engaged with more than 5 transactions of teleconsultation cases in a month.

Identified Category of Benefit	In terms of?	Mode of cases? (Emergency / Non-Emergency)	Examples of excerpts
Fulfill demand for specialist access	Consent purpose	Especially in emergency cases	<p><i>"We need to have the consent from the specialists. Teleconsultation would help in delivering image and patient description to them so that the specialists can make quick decision about the patient"</i></p>
	Specialist advice	Both modes	
Better utilization of resources	Tertiary bed	Especially in emergency cases	<p><i>"With the proper usage of the system, image transfer together with proper description letter sent through the system, the medical officer at referral hospital can choose properly the best patient to occupy the bed in the tertiary hospital... which is normally very limited"</i></p>
	Ambulance	Especially in emergency cases	<p><i>"I can see the users really utilize teleconsultation whenever they need to send cases. No more ambulance as the mode of carrying report and film to tertiary hospital"</i></p>
	Traveling Cost and Time	Both modes	<p><i>"Most of all, the consultants now don't have to travel more. The doctors and consultants can communicate and do the exchange of information with each other. The consultant could advice the doctor from remote"</i></p>
Reduce mortality and morbidity	Save patient life	Especially in emergency cases	<p><i>"The impact of teleconsultation in the case of neurosurgery is it can save patient life"</i></p> <p><i>"There was one case where patient died in the ambulance while being transferred to tertiary hospital and this happened when teleconsultation was not available. I am very sure teleconsultation could have avoided incident like this"</i></p>
	Value of life	Both modes	<p><i>"The most important thing is... it can reduce morbidity and mortality which you cannot put a value to it. Even though the implementation cost a lot of money"</i></p>
Reduce patient movement	Improve patient care management	Both modes	<p><i>"In terms of patient care management it will reduce patient movement so that it will also cut down a lot of cost particularly it would reduce the use of ambulance"</i></p> <p><i>"The patient can be treated at the primary hospital. All they need are procedures which can be given from distance. This will avoid the unnecessarily patient transfer, which create problem not only to the referral hospital but also to the relatives of the patient"</i></p>

Table 2: Critical Benefits of Teleconsultation

Category	Item	Mean	S.D
Supportive	1. I think teleconsultation is a quick way to specialist access	6.28	.638
	2. I think teleconsultation can broaden more specialist access options	6.32	.601
	3. I think teleconsultation would enable me to accomplish medical task effectively	6.18	.738
	4. I think teleconsultation could improve the way I cooperate with doctor or specialist	6.13	.838
	5. I think teleconsultation could improve referral management	6.26	.650
	6. I think teleconsultation could improve overall effectiveness of patient care management	6.35	.585
Critical	7. I think using teleconsultation could reduce patient transfer or admissions from primary to tertiary hospital	6.06	1.005
	8. I think teleconsultation could quicken the process to get specialist consent in critical conditions	6.40	.573
	9. I think using teleconsultation could save patient life	6.58	.496
	10. I think teleconsultation could reduce travel time and cost between primary to tertiary hospital	6.24	.702
	11. Overall I think teleconsultation could reduce the patients' unmet need.	6.24	.593

Table 3: Measurement Items of Teleconsultation Benefits and Likert Scores

5. Conclusion

This study helped to identify and acknowledge some important benefits of teleconsultation technology to health care facilities, providers and patients. We used an exploratory mixed method approach for data collection and analysis as to better interpret the phenomenon of teleconsultation activities and its potential benefits. The findings confirmed that teleconsultation service could improve health care in the underserved areas to consult with specialist. One of the important insights revealed that the store-and-forward teleconsultation was found acceptably feasible and has provided great assistance in the emergency setting. Overall, the results of this study can be used to promote teleconsultation as an effective means in delivering better health services. Some cautions should be a matter of concern if the findings were to be generalized as the study was confined to public health care facilities in Malaysia. Thus since the data were collected during the stage when the new teleconsultation technology was recently implemented, both of qualitative and quantitative studies were cross-sectional in nature. In respect to theoretical development and future work, the categories that were generated from these studies may be used for the development of perceived benefits and usefulness measurement tools in exploring acceptance and adoption of teleconsultation technology as the overall items demonstrated acceptable reliability.

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