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EXPLANATION OF EFFECTIVE FACTORS ON TELE-CARDIOLOGY ON THE BASIS OF EXPERIENCES OF PROVIDERS AND RECEIVERS OF SERVICE: QUALITATIVE STUDY

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ABSTRACT

Introduction: Nowadays cardiovascular diseases are considered as the main reasons of mortality in the world. Tele-cardiology is regarded as one of the ways in reducing the effects of heart diseases and reinforcing health's chain and the relations between general practitioners and cardiologists. The purpose of this study is explanation of effective factor on Tele-cardiology on the basis of experiences of providers and receivers of service. **Methodology**: This qualitative study is related to analysis of traditional content which was performed through semi-structured interview 14 people of Tele-Cardiology Users that were chosen by targeted sampling. Information until reaching to complete saturation of data were collected and analyzing data were done by analysis of them. **Findings**: By analyzing data, 3 main themes, 13 categories and 27 sub categories have been acquired. The themes included "chances", "challenges" and "solutions on promotion in using new technology". **Conclusion**: Findings of this paper have prepared better perception about barriers, chances and finally solution of promoting this system because of using experiences of telemedicine system users that can be good guidance for policymakers and involved people of health to planning for elimination of obstacles and advancement of goals related to quality's correction of telemedicine services.

KEYWORDS: telemedicine, Tele-consultation, Tele-cardiology, chance, challenge, analysis of qualitative content.

INTRODUCTION

Problem statement

Nowadays, cardiovascular diseases are regarded as the main reasons of mortality and disability in the world and also in Iran (Hazavehei, et al, 2014). As the most current reasons of hospitalization and readmission of patients in medical centers are heart difficulties (Idris et al, 2015). Vascular diseases because of exasperating condition of patient, rate of mortality and high afflictions that they have, finally injure quality of life and exact considerable economic cost and social burden to the society (Mohammad Zadeh and Safdari, 2015). So, prevention from this chronic disease and its management seem so important. Because of progression towards medicine and technology, using modern technology in order to correcting pursuance and management of this disease is inevitable (Mohammad Zadeh and Safdari, 2015). This issue, in turn causes introduction of telemedicine as a potential device for reducing possibility of intensification of heart disease and repeated and long-term hospitalizations (Kotb et al, 2015).

Telemedicine means preparing health care services by using communications and information technologies in a condition that the provider of health care and patient or two providers are not on the same geographical region. Telemedicine includes safe transmission of medical data and information through text, voice, image or other required methods to prevention, diagnosis, treatment and pursuance of patient (Brunetti et al, 2015). Tele-cardiology is one of the developing fields of telemedicine about heart patients (Raikhelkar, 2015). Actually, using information and communication technology to facilitating function of cardiovascular when doctor and patient are separated by geographical distances, is called Tele-cardiology. Tele-cardiology is the transmitter of ECG signals and Echocardiography images through different kinds of Tele-communications technologies from house or clinics related to special centers of heart diseases that can be done by storage and transmission or real time (Supriyanto). Tele-cardiology is an important diagnosis device (Tsipis) that is strengthening the health chain and relationships between

general practitioners and cardiologists (Van der Heijden and Witkamp, 2015).Collected data from some studies, represent that this technology considerably will help especially in correction of effectiveness related to care health by decreasing affliction and mortality (Yew), better management of heart patients related to early cares (Nikus et al, 2011. Supriyanto), optimized usage of hospital resources (Supriyanto), correction of pursuance's rate of patients and also solving the problem of unequal distribution related to cardiologists. The study of Khader and his colleagues represented that by using Tele-cardiology, 50% of travels, 96% of time and 100% of costs have been decreased (Khader et al, 2014).

Tele-cardiology includes wide ranges of functional programs such as Tele-echocardiography, Tele-ECG, simultaneously or asynchronous Tele-consultation, the concept and idea of secondary expert, electronic training, Mobile-monitoring of blood pressure and vital signs, moreover Tele-Cardiology can have useful usages in prison system, pediatrics and embryonic cardiology (Oliveira Jr et al, 2015). Meantime, Tele-ECG is a proper device in determining people who are suffered to heart diseases that may need to be immediately referred to hospitals or even urgency medical services. Clinical applications of Tele-ECG can be categorized as pre-hospital, in-hospital and after-hospital. Singh and his colleagues in their studies remembered Tele-ECG as a portable device, effective cost and proper device to diagnosing and monitoring heart diseases that leads to correction of services related to quality and access in rural and remote regions (Singh et al, 2014).

Geographical extent and dispersion of Iran population and unequal distribution of experts and hygienic facilities (Saeedi Tehrani and Noroozi, 2015) and also the rate of increasing affliction and mortality of heart diseases (Hazavehei et al, 2014)are important in Tele-cardiology device in our country and consequently for more perception in promoting and eliminating possible problem of this new technology, we use work experience of people related to this field and perform qualitative study by the idea of comparing challenges and Tele-cardiology chances from providers and point of views related to receivers of services.

METHODOLOGY

This paper is a qualitative study type analysis of traditional content that was done to expressing effective factors on Tele-cardiology on the basis of providers and receivers of services experiences at centers which are connected to server. Sampling was done goal-oriented from people who had work experience by Tele-cardiology and included 4 heart residents from Namazi hospital and 10 personnel of urban and rural hygienic-medical centers of Fars province. The way of executing the plan was a semi-structured interview. Questions were open responses and the main proposed question was: "What is Tele-cardiology device, how does it work and what is your role" which was designed by checking texts and idea of informed counsellor. The interview started with this question and then guided according to the responses of participants in the process of interview for this study. Duration of each interview was 20 minutes on the average which was done by verbal or telephonic interviews because of far distance to hygienic-medical centers. Interviews continued by journalism recorder device (except 2 interviews which were not recorded on their requests) and collecting data continued until repeating data and saturation of information (lack of access to new information). The interview was performed on the offices of participants and on their desired time. After completion of each interview, its text was copied word by word on paper and was typewritten. In the process of analysis which was started as the same time with interviews, at first pre-existed theories were left and then the text have been read many times to receiving complete perception of them and in the next step, meaningful units have been determined and early codes were extracted. Early codes have been placed in one categorization on the basis of their differences and similarities and then sub-categories were created. For extraction of codes, any especial software was not used.

To be informed about accuracy and validity of collected data, factors such as variety in participants regarding experience, profession, location of service, gender and also leaving experiences and presuppositions of the researcher, carefulness in registration of data, goodness of relation to participants, long-term involvement in field and data related to the interview, revision by participants and consultation with two experienced professors in the field of qualitative study about received codes and contents were considered. These items were performed on the basis of four proposed criteria (reliability, portability, reputability, ability of verification) by Lincoln and Cuba about reliability in qualitative studies (Golafshani, 2003).

To obeying moral considerations of the study and protection of participants rights by presenting written letter of recommendation obtained from university, they allowed to the responsible people of Namazi hospital to be interviewed. For interviewing participants of service at first they explained to doctors about type of interview, nature and goals of the study, way of data collection and using them and in case of approval, time and place of doing interview at offices of doctors and Namazi hospital were determined. Before starting interview of participants, written testimonial will be given. About receivers of services at urban and rural hygienic-medical centers telephonic interview and mentioned issues about observance of moral points have been performed orally because of far distance and dispersion of centers related to telephonic interview.

Findings

In this study, totally 14 people were participated included: 4 health residents of Namazi hospital, 6 nurses, 2 obstetricians, 1 IT connector, 1. responsible person for

urban and rural hygienic-medical centers. All of them have experiences in Tele-cardiology. In analyzing interviews, 274 codes were obtained and after omission and integration of repeated and similar codes, 3 main themes which included 13 categories and 27 sub-categories have been presented in table 1.

Table 1: Main and secondary themes obtained from the study

Rank	Theme	Categories	Sub-categories
1	Chance	Growth in effectiveness cost	Prevention from inessential dispatch and reference of patient and decreasing cost. Decreasing expectation time of patient and doctor. Doing necessary medical actions at least time. Reduction of medical fault. Simultaneous transmission of data. Fast access to patient's information and creating electronic file.
		Growth in society health	Access of denuded and remote regions to the hygienic-medical services. Decreasing damages and rescuing patient's life. Group decision making about patient.
		Increase of trust to the doctor	Collaboration of experts in hygiene centers. Giving more complete history by doctor of the center. Increasing satisfaction of the patient
		Benefits of technology	High quality of services. Registration and storage of data. Giving electrocardiogram on offline. Proper size of the device.
2	Challenge	Technology problems	Infrastructure of weak ICT. High cost of equipment. Time-consuming of device's launch. Hardware problems.
		Organizational-management problems	Insufficient knowledge in using the device. Lack of motivation in doctors. Growth of work rate in personnel. Shortage of human force.
		Lack of trust to direct technology to the Internet	Lack of presence on patient's clinic. Related diagnosis to history of doctor of the center. Doubled stress of the patient.
3	Solutions related to promotion of new technologies usage	Using superseded technology.	
		Tele-consultation in other medical issues	
		Transmission of data to the mobiles of the doctors	
		Placing the device in the ambulance	
		Storing electricity in theirs	
		Removing mentioned challenges	

Main themes included chances, challenges and solutions of growth in using new technologies.

1. Chances

Chances were the first abstracted themes of this study. This theme included growth in effectiveness cost, growth in society health, increasing of trust to the doctor and benefits of technology.

1.1 Growth in effectiveness cost

Most of the participants have mentioned because of the importance of time in treatment of heart patients and as a result of medical actions at least time which is related to simultaneous transmission of data and consultation to experts and also if necessary, coordination with professional centers in order to necessary preparing in admission of patients that finally causes reduction in consuming time. The second participant expressed about this issue: they called us at that time, we were there, we immediately observe ECG and determine plan (actions which they should do for the patient) of the patient".

One of the items that explained by most of the participants, was reduction of medical fault because of wrong diagnosis related to the doctors of hygienic centers. Using this system can refuse unnecessary dispatch and reference and as a result imposition of extra cost to the patient. The first participant explained about this issue: "Some of them were normal, it means they were faults of the doctors and if we had not guided them, it would have caused costs and work ups for the patient. It was not necessary for him to be with the patient.

Fast access to the patient's data and creating electronic file because of the feature of system in registering data was one of the benefits of Tele-cardiology system which was presented by receivers of the service. Participant 7 explained on this issue: "It is registered on the computer, you can again make copy whenever you want, we create a file for a patient, if you want ten or twenty ECGs they can register them". Participant 9 said: "Each patient has one file, as a result the investigation will be easier and you can record it in the computer or by hand".

1.2 Growth in society health

Participants acknowledged that because of connection to the more equipped center and consultation to more senior people, access to the hygienic services has increased. They also expressed group decision makings about patients which cause reduction of damage and rescue of patients and finally growth in society health, as benefits of this plan. The fifth participant expressed: "We are in round-the-clock clinic and there are not any cardiologists and our doctors are GP. We can simultaneously consult the patients to cardiologist, it means that it is the main reason which they have created Tele-cardio.

1.3 increase of trust to the doctor

Some of the participants expressed that using the experiences of specialist leads to increase in satisfaction and self-confidence of the patient which will be effective in better decision-making and growth in patient's spirit. The participant 10 explains: "He will get oriflamme, if I am in a rural center and now someone is in a center of a province and talking about me which I need to work more or not".

Registering more complete and faster history of the patient by doctor of the center that can be more useful than history of the patient, was another benefit of this plan. The participant 11 states: "There is no difference that I want to investigate the history or that doctor performs it because finally my connector to that patient is also a doctor as my level and is completely oriented to medical issues, so there is no difference that the patient is seating in front of me or my connector to that patient is a doctor".

1.4 Benefits of technology

Used new technology in heart diseases regarding quality, low volume of the device, taking ECG on offline and registering and storing data was acknowledged all receivers of services. Participant 9 states: "It exactly takes ECG". Participant 12: "Its quality is good". Participant 14: "It files for each patient".

2. Challenges

The second resulted theme from qualitative data was challenge on executing this plan that included 3 categories and 11 sub categories. Categories of this theme include: technology problems, organizational-management problems and lack of trust to direct technology on Internet.

2.1 Technology problems

Technology problems mentioned by participants were more about weak infrastructure of ICT (not connecting and turning off the Internet) and consuming time of device launch. Personnel said that preparation of device for taking ECG is time consuming, as a result about urgency and ill patients they have to use older device and we can regard it as the most important problem of this system. Participant 6 said: "Our biggest problem is that we do not have good infrastructure to be connected and transmitted". Participant 6 stated: "Almost it takes a long to register patient's specifications and turning the computer on, the patient will be waiting".

Other stated problems by participants are about hardware that was said for taking ECG and its transmission, all the equipment should be ready and safe and most of the time some of the equipment are out of orders because of lack of knowledge related to personnel in using them and also high cost of system's equipment. Participant 6 explains: "Our operators do not have sufficient knowledge to be started, if the cable turns off how it will start? How we can connect the printer?". Participant 3: "They paid a lot on this issue".

2.2 Organizational-management problems

Insufficient knowledge in using device that can be because of insufficient training was an issue which mentioned by almost all participants as main weakness of this plan. Participant 1 discussed: "Most of the time they called us that we knew there was something but we did not know how to work on it". Participant 8: "They instructed more, all the nurses of our center can not completely take ECG by that".

Also lack of motivation, high volume of work and lack of personnel that participants have mentioned are factors that lead to resistance of personnel in using this device. Participant 4 said: "We don't have any motivations to continue this work because this work is out of our educational system and it takes times". Participant 8: "In hospitals because of lack of absence of paramedics, I work as them but if there are paramedics, they will take ECG and transmit".

2.3 lack of trust on Internet

The importance of presence on the clinic of the patient and its face examination and also decision-making of the doctor on the basis of ECG and discussions of center's doctor were proposed disadvantages by providers. They think that this system is useful if a complete and proper history will be presented to them by the doctor of the center. Participant 2 explains: "If they don't call us and don't give us the history of the patient, they will not have big effects". Participant 3: "Patient's clinic is so effective".

Creating double stress in patient also in the condition of knowing about transmission of his ECG to more equipped hospital was one of the disadvantages. Participant 2: "Maybe I have an acute problem because they calling a higher center and this issue increases stress of the patient".

3. Solutions or growth in using technology

The second theme was solutions or growth in using new technology that includes these categories: using superseded technology, Tele-consultation and in other medical issues, transmission of data to the mobiles of the doctors, placing device in the ambulance, storing electronic in the device and elimination of mentioned challenges.

According to experience and statements that participants mentioned about using social networks and consultation to the doctors, we can use these networks as superseded technologies in condition that the Tele-cardiology is out of order. Participant 1: "They take my number of what's app and I tell them in what's app what should they do".

Transmission of ECGs related to Tele-cardiology system to the mobiles of the doctors can be helpful in consuming their times and creating motivation in them. Participant 3: "They should give us mobile cellphones then we do not get tired of being 24 hours in a room".

Placing system in the ambulance and centers of urgency and medical services were done to promoting and correcting the system. Participant 3: "It's better to apply systems for ambulances and also personnel for them".

Other proposed issues by participants to removing problems of the device are storing energy and ability to charging the device when there is outage. Participant 8: "They should make them rechargeable to keep charges". The third issue is holding more educational sessions in order to growth in knowledge and skills of personnel in using this system and reinforcing the ICT infrastructure for better and faster connection to the central server. Participant 6 states: "If infrastructure and knowledge be together, it will be so great. We have given the ECG less than 2 minutes, transmitted it to Shiraz and called them".

According to their experience in the field of one types of the Tele-medicine, participants stated that we can use this system in order to consulting in other issues such as: Response of the test, radiology, NST, diet and etc. participant 9: "Heart monitoring is useful because there are lots of heart patients". Participant 12: "Ultrasound or radiology which need to more consultations".

DISCUSSION AND CONCLUSION

Findings of this study indicated an image of effective factors on Tele-cardiology on the basis of actual experiences of providers and receivers of services. Obtained themes are the indicators of chances, challenges and solutions in promoting this technology.

Analyzing of data indicated that using Tele-medicine causes reduction in medical fault, refusing unnecessary dispatch and reference and as a result reducing costs. Hiratsuka and his colleagues also in their qualitative study stated reduction in travels costs as one of the benefits of Tele-cardiology (Hiratsuka et al, 2013). Also in a qualitative article as "Experiences of women and providers of services about therapeutic abortion thorough Tele-medicine", reduction of travel for doctor and patient were mentioned (Grindlay et al, 2013).

The other benefits of this plan which mentioned by participants were reduction in waiting time of patient and doctor, on-time therapeutic actions, simultaneous transmission of data and access to information of the patient. In quantitative study of El-Mahalli and colleagues, they mentioned storage and transmission of data and correction of health care (El-Mahalli et al, 2012). In quantitative study of Mehdi poor and colleagues also reduction of patient's waiting time was reported (Mehdipour et al, 2015).

Access to the services, connection to more equipped centers and group medical decision-makings as factors of reducing harms, were findings of this study. Salehahmadi and Hajialiasghari also reported reduction of affliction and mortality as positive points of Tele-medicine (Salehahmadi and Hajialiasghari et al, 2013). In

qualitative study of Grindlay and colleagues, more temporal and local availabilities were determined in compared to verbal meeting (Grindlay et al, 2013).

Participants in this study believed that consultation to a specialist will improve satisfaction of patients. Quantitative study of Najafi and colleagues was indicator the proper effect of Tele-medicine on patient's satisfaction (Najafi et al, 2015). In another research also maintaining of patient's satisfaction as a positive point was mentioned (Rogove et al, 2012).

From participants point of views about receiving complete history by the doctor of the center can be more useful than taking history by the patient. When the first face interaction and continuance of treatment are related to provider, he is maybe the expletive of the doctor and patient's relations in Tele-medicine. There were determined by findings of study related to Hiratsuka and colleagues (Hiratsuka et al, 2013).

High quality of taken images was another advantages of this plan that didn't correspond to the study of Mahapatra and Dantu which were mentioned lack of quality related to the images and this issue was because of variety in type of research (investigating many researches) (Dantu and Mahaparta et al, 2013).

Findings of this study indicated that weak infrastructure, hardware problems and high costs of equipment are the important barriers in executing this plan that these results corresponded to the study of Mahaparta and Dantu which was done by collecting articles (Dantu and Mahaparta et al, 2013). In qualitative study of Coates and Taylor, technical problems were mentioned (Tylor and Coates, 2014). Ghia also classified high costs of equipment, technical problems and lack of educated personnel in the field of IT as barriers of Tele-medicine (Ghia). In qualitative research of Fatehi, one of the success factors of establishing clinic of Tele-medicine was the presence of good and reliable mentioned technical infrastructure that did not conform to this study (Fatahi, 2014). According to the results of this study we can realize the importance of infrastructure in success of the Tele-medicine system.

Participants of this study believed that consuming time of the starting device is an important problem especially in time of the reference of urgency patient. Insufficient knowledge, lack of motivation, high volume of work and lack of human force are other challenging factors of new system. Findings of qualitative study by Taylor and Coates did not conform to these results (Taylor and Coates, 2014). Fatehi in his research mentions resistance of personnel against transformation as a barrier that can be in one line with lack of motivation and high works in this study (Fatehi, 2014).

Lack of trust to new technology includes lack of presence in clinic of the patient, decision-making related to doctor's history and doubled stress of patient are another proposed issues by the participants of this study. In study of Hiratsuka and colleagues, lack of face relation of patient and doctor reported as one of the Tele-medicine disadvantages (Hiratsuka et al, 2013). Elahi and colleagues in their quantitative study, expressed viewpoints of doctors about relationships of doctor and patient as negative (Elahi et al, 2013).

Solutions of promoting system which were expressed by participants included: Superseded technology, using other types of Tele-medicine, transmission of data to cellphones of doctors, placing device in the ambulance and storing energy in the device.

Findings of this study prepared better perception of barriers, chances and finally solutions in promoting this system that can be good guidance for policymakers and responsible people of health to planning in order to eliminating the problems and promoting goals of correction in Tele-medicine services.

Limitations

Some limitations of this research are unwillingness in of many Tele-cardiology users to participating in study and high distance to hygienic and medical services because of performing verbal interview. It is suggested to perform same researches about other models of Tele-medicine. In addition, experiences of patients in using this system will also be investigated.

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