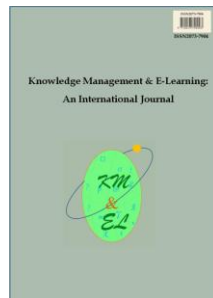

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Telemedicine implementation and benefits for quality and patient safety in Pakistan

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Abstract: Telemedicine is becoming an important aspect in developing countries to provide better health facilities. Rural areas in developing countries suffer due to lack of health facilities and face difficulties like time to reach health facilities at the faraway places, cost of reaching at a health care facility, and transportation needed to move around for the treatment/consulting purpose. Telemedicine could be used for safe and quality health by specialists at low cost in rural areas in Pakistan. Telemedicine services could be provided through video sharing, image sharing, mobile services or by e-mail. A research study was conducted to analyze the implementation and to explore the benefits of telemedicine in Pakistan. We distributed 150 questionnaires among teaching hospital doctors in city of Lahore, out of which we received 147 completed questionnaires. Three of the questionnaires were rejected due to incomplete information. The questionnaires were given to participants in the scheduled classes and collected at the end of class. Instructors were requested to allow students to complete questionnaires. The results showed 66.32% doctors of teaching hospital agreed to implement telemedicine for rural areas in Pakistan. 78.9% doctors agreed that telemedicine will save travelling time and money for availing expert opinion. However, 30.6% doctors agreed that Telemedicine will be beneficial for urban community – obtained the lowest score. The enhanced link between doctors and telemedicine can contribute to provide better health

facilities in rural areas.

Keywords: Telemedicine; Information technology; Health care; Pakistan; Rural areas

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1. Introduction

Telemedicine could be helpful for providing safety and quality health care especially for developing countries like Pakistan. In Pakistan 60% population lives in rural areas and they do not have proper health facilities. They are not able to afford expensive treatment from big cities. Due to the Telemedicine patients could get timely access to specialists for quality health and their integrated health record could provide them safe treatment. Rural healthcare providers can get training for quality and safe treatment and encourage early interventions. Telemedicine can build a bridge between hospital and home.

Information technology (IT) has become a strategic need to improve health care services and reduce medical errors (LeRouge, Mantzana, & Wilson, 2007). Investment in IT was not an important aspect during the 1990s but now it seems as a mean for improved productivity, safety and quality (Wilson & Tulu, 2010). Information technology has brought enormous changes in two separate areas. First is the development of medical instrument such as MRI scanners and monitor equipment to computed tomography (CT). Second is the electronic processing of medical services and hospital bills such as Hospital Information Systems (HIS) and Electronic Data Processing (Armoni, 1999).

Harsanyi, Wilson, Daniels, Allan, and Anderson (1995) described consumer's expectations for better quality, service and cost effectiveness requires a new delivery health system. In this context, health organizations are trying to improve quality management, health networks integration, patient's record on computers that can be accessible from different places and patient centre reengineering. Integration is an important aspect for health care systems (Duan, Street, & Xu, 2011) that integrates patient's internal, external, clinical, financial and information data. Lucas (2008)

considered four different broad areas to improve health systems in developing countries such as awareness of Information and Communication Technologies (ICT) among general public, importance of telemedicine, diagnosis and treatment monitoring on computers and traditional health information system.

Burney, Mahmood, and Abbas (2010) described different emerging technologies in developing countries such as telemedicine, M-health, Bar code technology and radio-frequency identification (RFID), clinical decision support system (CDSS), picture archiving and communication system. Mobile and wireless technologies have been a rising trend in developing countries. It can be used to provide health information on different places. Kahn, Yang, and Khan (2010) described different applications of mobile communication that can cover large geographic areas for health needs. These applications are social networking, web surfing, electronic mailing lists, web-based learning and web based data entry. There are different challenges for m-health (Burney, Mahmood, & Abbas, 2010, p. 28) such as “1) Provision of rapid response to critical medical care regardless of geographic barriers. 2) Interactive medical consultation and communication links of medical images and video data 3) Establishment of a strong ICT infrastructure in developing countries that is able to cater the bandwidth and availability requirements.”

This paper would add value in helping the health care providers to invest in the Information Technology to provide timely help to the patients. It would be helpful to the state as more and more patients would be getting the much needed medical help at the fraction of cost in their own environment. This paper explains the telemedicine and telemedicine in the developing nations with reference to Pakistan.

2. Telemedicine

Information technology has brought enormous changes in every aspect of life that includes banking, commerce, education, entertainment and health care as well (Bashshur, 2002). In health care, Information technology allows the quick interaction between patients and physicians without the barriers of time and distance. Telemedicine is the exchange of medical information from one site to another (American Telemedicine Association, n.d., para. 1) Through diverse collection of technologies and clinical applications (Perednia & Allen, 1995). Technologies are being used in exchange of information i.e. two-way video, email, image sharing, smart phones, wireless tools and other form of telecommunications. World Health Organization (WHO) (2010) has defined telemedicine as transfer of services for diagnoses, treatment of injuries, research and evaluation and for the education of health care providers. Distance has been described by WHO as a critical factor for providing telemedicine services. Wootton (2001) described the use of telemedicine in three different categories such as 1) clinical (diagnostic and therapeutic) 2) educational and 3) administrative. In 1950s telemedicine was only used for astronauts to send their vital signs but recently has been used for critical care, ophthalmology, dermatology and cardiology (Heterington, 1998). The effective use of telemedicine has been observed in different sectors such as Department of Defence (Carmona, 2003) critical care (Berg, Vincent, & Hudson, 2003) and rural clinics (Armer, 2003). Telemedicine has advantages for patients and physicians. Time is a key factor in providing treatment to patients. Patients can have timely access to specialists and can get proper care. They can avoid unnecessary admission and readmission if treatment would have been available at homes or close to their homes. A nurse-led telemedicine in Scottish rural village combined a referral protocol with video consultation proved satisfactory for doctors, nurses and patients. This system helped

patients to understand different points even after consultation with their doctors. It also reduced the increased number of patients to physicians (Macduff, West, & Harvey, 2001). Telemedicine allows physicians to extend their expertise to developing areas and can increase their exposure as well. It allows physicians to save time by reducing travelling that will increase their quality of life and productivity. The correction system (Telemedicine) in Texas was introduced by Texas Tech University Health Sciences Center and the University of Texas Medical Branch at Galveston (Reed, 2005). They had to look after 200, 000 inmates in 124 prisons scattered over 267,000 square miles and objectives were to avoid unnecessary emergency room trips and quick hospital admissions for prisoners.

3. Telemedicine in developing countries - Special reference to Pakistan

Medical and health care services are not available in least developed countries and suffering from shortage of health professionals and doctors. The main problems coming in providing proper health care services in rural areas are roads, poor transport and telecommunication infrastructure. The use of telemedicine in developing countries is limited for educational purposes at the moment. SatelLife organization is a known example which is providing assistance to 4000 health workers in 30 developing countries (Groves, 1996). Most of the work is being done by asynchronous mode to avoid expensive, high-speed communications. Asynchronous mode that is also known as “store and forward” is cheaper and convenient method of transmission for telemedicine (Smith, Bensink, Armfield, Stillman, & Caffery, 2005). E-mail, fax and post are the examples. It allows the opportunity to recipient to examine information at his/her ease. Second mode is real time (synchronous) telemedicine that allows participants to send and receive information immediately. Telephonic and video conferencing are being used in this mode. “Hispano-American Health Link” program develops low-cost telecommunication and information services for healthcare personnel in developing countries (Martínez, Villarroel, Seoane, & Pozo, 2004). Their program consist on five steps such as 1) research for the needs of communication and information in developing countries 2) Research and development on data communication and voice systems to design according to rural areas 3) Research and development on information systems 4) formation of pilot projects 5) evaluation of these telemedicine systems. Wootton (2001) has described different counterargument for the clinical use of telemedicine such as 1) Is it fine for health-care workers to take action on the advice received from different telecommunication resources? 2) Are there any other cost effective alternatives of telemedicine? 3) Is there any assurance that the offered advice is correct? Above questions have solid reasons and can be answered through pilot trials and proper evaluation.

There are concerns about practical use of telemedicine in developing countries. Some steps need to be determined for the use of telemedicine (Wootton, 1997) such as 1) Pilot projects needs to run to demonstrate technical feasibility (Wootton, 2001) 2) cost calculation is also an important step to make it possible at a large scale. The other important step for telemedicine is the level of information available in developing countries (Wootton, 2001), such as what it is, and how it will cover gaps in health care? The financial factor of telemedicine cannot be neglected for least developed countries. The participation of local population, external door agencies and telecommunication operators is necessary to have a chance of success. The trend of aging rapidly is expected in coming decades among developing countries. The numbers are expected to increase from 249 million to 690 million between 2000 and 2030 (Kinsella & Velkoff, 2001). The

aged people are at high risk of disease and disability so that requires a proper health care system to facilitate them with proper health care facilities, nurses and physicians. Marcelo (2009) described the educational and clinical use of telemedicine by giving the example of the University of the Philippines Manila National Telemedicine centre. It was established in 1998 and providing referrals from more than 40 doctors that is connecting them to 600 experts at the Philippine General Hospital. The project is working on three different case studies such as community health information tracking system, E-learning for health project and SMS telemedicine project. The migration of health professionals from rural areas of Philippines raised alarm for the care system of these people but e-learning health project made it possible for authorities to teach community health workers. Telemedicine has been used for administrative purposes as well, such as management meetings, candidate's interviews and contact between regional sites (Smith et al., 2005). Bashshur (2002) described different problems in health sector such as health care access, cost inflation, geographic variations and gap in medical care and proposed solution such as accessibility enhancement, quality improvement and cost containment.

Pakistan comes in populated countries of the world that has four provinces and total population is about 162 million. Pakistan is an ideal candidate for telemedicine because of its poor health infrastructure, poor road network in rural areas and while serious development in the telecommunication sector.

Table 1

Health care facility (Ministry of Finance, Government of Pakistan, 2014)

Health Manpower	2013-2014
Registered Doctors	167,759
Registered Dentists	13,716
Registered Nurses	86,183
Population per Doctor	1,099
Population per Dentist	13,441
Population per bed	1,647

Above Table 1 shows the figures of health facilities available to Pakistanis in 2013-2014. It shows the lack of doctors, nurses and infrastructure to patients in Pakistan. Pakistan is also effected by sever natural disasters such as earthquakes, floods and droughts and lack of infrastructure makes it quiet difficult to handle emergency situations. Government has two options at the moment: first is to build hospitals and big infrastructure to meet current needs or by promoting telemedicine in rural areas (Ullah, Khan, Sultana, & Kwak, 2009). Ullah, Khan, Sultana, and Kwak (2009) described different projects are working in Pakistan such as TelMED PAK (with the collaboration of USAID in Taxila and Gilgit), SUPARCO space agency working on different projects of telemedicine, PAKSAT-Health Net working on telemedicine infrastructure in different rural areas such as Rajanpur, Jhang, Shikarpur, Mirpurkhas and Jacobabad. National disaster management with the help of Telecare (PVT) Ltd started telecare facility at Badin for flooded areas. These projects are providing a limited solution as compare to huge lapses in infrastructure and health facilities in Pakistan. The other major concern for Pakistan is the increasing population and their health concerns. There is a need of serious

effort on national level to work and establish a mechanism that can support telemedicine in order to avoid major future health concerns in Pakistan.

4. Methodology

This research is based on primary data. Data was collected through questionnaires. The questionnaires were made up of two demographics questions such as gender and age and ten questions to measure the benefits toward the implementations of telemedicine in Pakistan. Questionnaires measurements for implementation of telemedicine were taken from (Ghia, Patil, Ved, & Jha, 2013, p. 3). Teaching hospital doctors in the city of Lahore were targeted to measure the benefits of telemedicine. The simple random techniques were used to collect the data. We delivered a brief lecture on telemedicine to target audience and distributed 150 questionnaires. Out of 150, 147 were usable and remaining three got rejected due to incomplete information. To complete this study and find out results, data responses were scored and statistically analyzed through SPSS version 20. Results were expressed as frequency percentages.

5. Results

The first step in the analysis was to clean data from missing values. One hundred and forty seven questionnaires were usable out of one fifty. Therefore, the response rate was about 98% (Table 2).

Table 2
Descriptive statistics of gender

Gender	Frequency	Percent	Valid Percent
Valid			
Male	67	45.6	45.6
Female	80	54.4	54.4

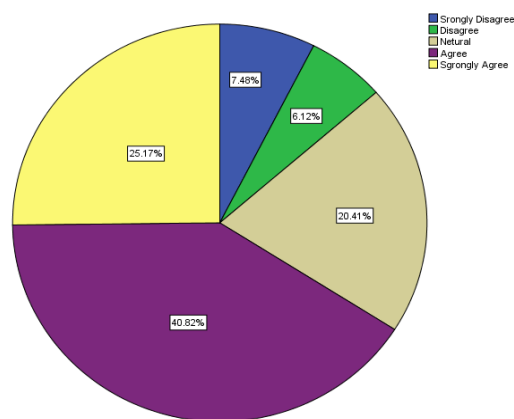


Fig. 1. Telemedicine should implement in all the hospitals equipped with internet facility

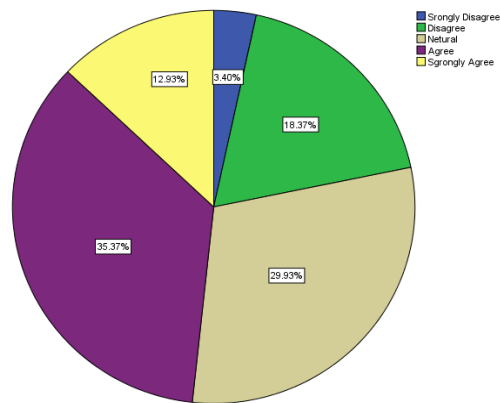


Fig. 2. Reliability of consultation by telemedicine will be poor

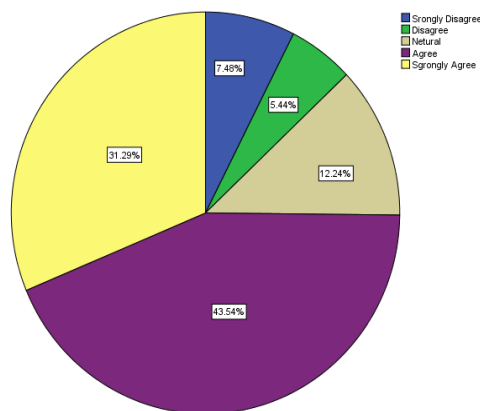


Fig. 3. Telemedicine will help in easy access of health care services for rural patients

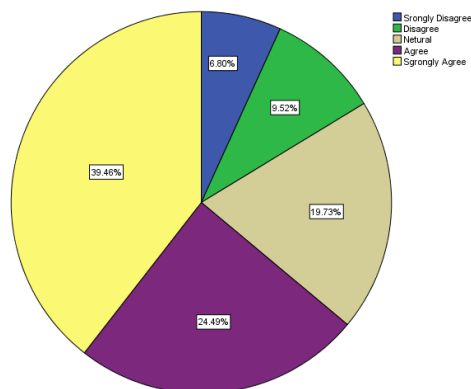


Fig. 4. Telemedicine can never replace face to face consultation

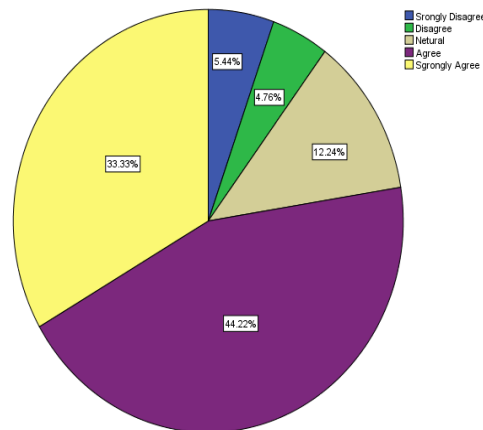


Fig. 5. Doctors will approve of telemedicine only after getting the statistical reports of the benefits of telemedicine

Further descriptive statistics, relevant to our study pertain to frequency tables with percentages. The frequency tables show response of respondents toward measure the benefits of telemedicine and its implementation in rural areas of Pakistan. The questionnaires used 5 point likert scale to analyze quantitative assessment proposed by the authors. A survey with ten questions used to measure benefits and implementation of telemedicine. This study used frequency tables with percentage to analyze responses of respondents. Some results of specific questions related to implementation of telemedicine are shown from Fig. 1 to Fig. 5 above.

In general, most of the respondents rated the survey with the highest scores, 4 and 5. This highest score depicts that doctors agreed to implement the telemedicine for rural areas in Pakistan. Results of specific questions about benefits of telemedicine are summarized in Table 3.

Table 3

Respondent results

	SD	D	N	A	SA
Telemedicine will save travelling time and money for availing expert opinion.	7.5%	6.1%	7.5%	55.1%	23.8%
Telemedicine will benefit only the urban community.	6.8	27.9	34.7	17.0	13.6
Telemedicine will help to save patients time.	7.5	8.8	18.4	49.7	15.6
Telemedicine will help to save patients money.	4.8	4.8	21.8	52.4	16.3
Telemedicine prevents from worsening of the medical condition of the patient.	9.5	12.9	29.9	38.1	9.5

SD=strongly disagree (1), D=Disagree (2), N=Neutral (3), A=Agree (4), SA= strongly agree (5).

The question, telemedicine will save travelling time and money for availing expert opinion achieve highest scores 78.9% with combining the 4 and 5 scores. The question, telemedicine will benefit only the urban community achieve the lowest scores with combining 4 and 5 scores (30.6%). Furthermore, 77.5% doctors will approve the telemedicine only after getting the statistically reports of the benefits of telemedicine. It is a good indicator because implementation of telemedicine globally is increasing day by day. The third highest scores obtained is 74.8% for the question, telemedicine will help in easy access of health care services for rural patients.

6. Discussions

This research aims at implementing telemedicine in rural areas in Pakistan to improve quality and safe health conditions. This study shows doctor's satisfaction towards implementation of telemedicine in rural areas of Pakistan. According to this study, 66.32% doctors agreed to implement the telemedicine in Pakistan. The satisfaction level toward the telemedicine is also 58.22%. Telemedicine concept has been accepted globally and has advantages as well. It saves time for travelling and money. Second it increases access of specialist doctors with numbers of medical opinions. Telemedicine is superficial for developing countries than developed countries (Edworthy, 2001). Hence, Pakistan is a developing country and doctors are not available to meet the growing demand that would increase the importance of telemedicine. Wootton (1997) suggested that telemedicine could be useful technique for developing countries with consideration to logical steps to implement. It could be used for educational purposes to teach and train health care professionals. Health care professionals from rural areas can learn from centralized institution and can save cost and time. Telemedicine could be an investment opportunity for information technology vendors and can make developing nations' health care system sustainable.

7. Limitations

This study has certain limitations that give direction for future research. This study relies on small sample size. However, sample size represents reasonable audience to conduct the study because target doctors belong to different rural areas of Pakistan. In comparison, this study could be used with large sample size to show the clear picture for further results. Research could be directed towards the patients instead of doctors to measure their satisfaction for telemedicine.

8. Conclusion

This research demonstrates the importance of telemedicine and information technology and their integration in rural areas of developing nations like Pakistan. People in rural areas would be able to get proper health services without sacrificing travelling cost and travelling time. Telemedicine is also helpful for doctors to provide their services in the most effective and efficient way. At the same time, it could be helpful in controlling urbanization problem in Pakistan, if proper health facilities could be available in rural areas. Telemedicine facilities should be made according to social and economic factors in Pakistan like literacy rate and affordability.

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