
Effectiveness and Future Prospects of Telemedicine/Remote Health Care Management Applications in Pakistan

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ABSTRACT

Medical/Health care system is spraining in Pakistan because of innovative technology, activities and services as per their financial cost (position) which is increasing day by day. This research is intended for the assessment of Telemedicine/Remote Health Care Management practices (system), which encompasses usability, acceptance and impact in public/private hospitals. To improve the existing remote health care/telemedicine practices in Pakistan by using EM (Engineering Management) based approach. It has been widely and successfully implemented and is considered as a strategic and operational tool. In the 21st century due to the Technological advancements the mode of operation of service and business sector have been changed drastically. In the same way the health sectors activities also have been altered, new methods and techniques have also been devised for the treatment of the patients that were never even thought before. In the health sector Telemedicine/Remote Health Care Management is one of the development which was experienced lately. Telemedicine/Remote Health Care is taken exactly, "medicine at a distance". Therefore, hypothetically, some procedures performed with medication which does not take place "face-to-face" and "in person" which can be considered as Telemedicine/Remote Health Care. In the industrialized world telemedicine is being used in full capacity to provide the health care services to remote and un-accessible areas. But Telemedicine/Remote Health Care Management is not very popular and admired in Pakistan; few applications are being functional presently.

Key Words: Engineering Management, Operational Assessment, Medical/Health Care, Health Services Management, Public Hospital in Pakistan.

1. INTRODUCTION

Health Services Management is emerging to be an important and urgent issue for Pakistan. The rising need of doctors, hospitals, and other medical facilities requires progressive and dynamic solution, implemented and operation in a prompt manner. Multidisciplinary studies especially in the areas of

engineering management can help health services to attain decreased costs, optimize services quality, and increased customer satisfaction. The problem although is multidimensional but also possess significant opportunities in itself such as implementation of remote diagnostic and healthcare systems. These systems are

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already dominantly employed in Pakistan and the main focus of writing of this paper is to develop a framework to right to use the effectiveness in the matter of response and effect benefits of healthcare systems through remote diagnostics.

Although, the incorporation of remote diagnostic function is rather a contemporary measure but the core dimensions of healthcare of as primitive as its consumers- human beings. Every consumer of remote services requires a certain level of resourcefulness, user friendliness, and service quality that can ensure the possibility of care as available in core facilities – this acquires the organization a competitive edge over its substitutes. Second concern is to increase the customer satisfaction in regards to observe, evaluate, and enhance the involvement of workforce through professionalism, knowledge ability of the services, and knowledge ability of the technology on hand, organizational rules, and after sales services. Finally, the major concern for such organizations is the lean manage the costs involved in healthcare operations because price of technology, price of infrastructure, and current financial position of the venture are paramount concerns so overall organization performance can be enhanced.

Medical/Health Care organizations are under tough stresses to make the improvement. Due to of the society aging, medical/healthcare services demands are increasing on the daily basis, but the medical/healthcare financial systems are not getting better in any system. In the current millennium, medical/healthcare systems are in a continuous challenged phase, so as to be very much reasonable/accessible, safe/efficient and cost effective. Due to this reason there is a dire need for searching out the new, advanced and more efficient procedures to provide medical/healthcare facilities to all the people. Information security and privacy in medical/healthcare sectors is becoming a serious issue

of emergent importance in these days. Due to the recognition of the digital patient records, improved regulations, medical/healthcare provider's consolidation and continuous increasing requirements for information between patients, medical/healthcare providers and payers, all points are approaching towards the requirement for the better information security. As per Goldschmidt the recent government initiatives think about the adoption of a universal EHR (Electronic Health Record) by all MHO (Medical/Healthcare Safeguarding Organizations) by the year 2014 [1]. According to Hillestad et. al. [2] the medical/healthcare information systems are viewed as particularly the most important factor in getting better the United States medical/healthcare system's quality and reducing the related costs and could likely to save \$81B annually by moving to EHR system and pointed out that IT (Information Technology) expenditures in the medical/healthcare sector trails that of many other industries, typically in 3-5% of revenue, far behind industries like financial services where nearer to 10% are the norm. The Health Privacy Projects are the subjective evidences from the current years propose be short of the sufficient security measures has resulted in several data breaches, leaving patients exposed to monetary threats, psychological torture and possible social stigma.

1.1 Problem Statement, Aim and Objectives

This study emphasises on improving remote health care management practices (system) in public/private sector hospitals in Islamabad, Pakistan. The aim of this study is to improve the existing remote health care/telemedicine practices (system) in Pakistan by using EM based approach and its objectives to find out the current level of adoption of innovation of health Care management practices among doctors; working in public/private sector hospitals of Pakistan. To evaluate the available speciality

knowledge on remote health care/telemedicine system, in Pakistan. To identify: Trusting beliefs and self efficacy faced by hospitals concerned in the execution of remote tele-health practices. To study the impact of perceived ease of use on remote health care system in Pakistan. To determine the impact of cost of technology on remote health care system. To observe the impact of financial feasibility on remote health care system. To find the impact of patient acceptance of remote health care system.

1.2 Research Questions

RQ-1: What is the current level of adoption of innovation, available speciality knowledge, trusting beliefs and self- efficacy, perceived ease of use, cost of technologies, financial feasibilities and patient acceptance of health Care management practices (system) among professional doctors; working in public/private sector hospitals of Pakistan?

RQ-2: What is the impact of practices of remote health care management (system) and needs in Pakistan?

RQ-3: What are the main challenges faced by hospitals and patients using remote health care Management system?

1.3 Significance of the Study

The significance of this research extends the impact of remote diagnostic health /tele-medicines practices: in Pakistani public hospitals which are beneficial to all three stakeholders; consumer, workforce, and shareholders. The study suggests beneficial input for public sector organizations to assist them in policy making and implementation. The paramount comprehension in this study is to formulate a design of such services to deliver them in “cheaper, better, and faster” ways.

1.4 Literature Review

As per Bashshurtelemedicine is referred as “an innovative bundle promising to achieve the threefold goal of improving access to care while limiting the rate of cost increase and maintaining quality” [3]. According to Bratton and Cody [4] another type of approach was used by the Mayo Clinic in a geriatric patient pilot study in Florida. The average of patients in the study was 77.3 years of age. The results were that 61% of the patients felt comfortable in using the system without assistance, and 72% were confident that the use of the system was giving them good care. Rogers [5] pointed out that the innovation-development procedure classify all the decisions and activities, and their impacts that take place from recognition of a need/problem, through research, development and adoption by users.

According to Fendrick and Schwartz the “technology imperative” to cure a patient is considered a major influence on the adoption of medical innovation [6]. Another important characteristic of both the physician and hospital organization is the necessity, in a very competitive market, to remain on the “cutting edge” of care in order to attract and retain patients. At the early stages, the development of the analogue telecommunication technology such as the telegraph, telephone, radio, and later on developments in digital telecommunication technology have facilitated the application of telemedicine in various medical fields [7-8]. Use of Telemedicine/Remote Health Care technology earlier to technology acquirement to promote improved decision making of investments [9-11].

By permitting the transfer of specialty knowledge to the remote community, telemedicine reduces the knowledge gap of remote physicians thereby affecting their

diagnostic confidence [12]. In the medical field knowledge sharing between and among various categories of health care practitioners is an indispensable, accepted, and common practice across the world. Professional knowledge sharing among health professionals is significant to enhancing the quality and efficiency of patient care in health care facilities [13]. Additionally, it is essential that health care providers update their knowledge and expertise and keep abreast of medical advances and new medical information through reading medical books and journals, and attending morning rounds, medical lectures, conferences, and workshops [14].

In health care practices, apart from the medical knowledge, expertise, and communication skills, treatment of patients require some level of trust, confidence, and intimacy between health care providers and patients. On the one hand, telemedicine is a good solution for providing health care services to medically underserved inhabitants in rural areas, but on the other hand, it may cause emotional dissociative disorder and reduce the trust which identify the relationship between patients and medical/health care providers” [15]. Likewise, Styhre describe that “knowledge is what a certain collection of person think to how the world works” [16]. Knowledge sharing between various categories of health care practitioners is an indispensable, accepted, and common practice in the medical field across the world [17]. Furthermore, telemedicine, which is the application of ICT (Information and Communication Technologies) for health care delivery, and education of medical staff across distance, can play a significant role in knowledge sharing [18]. Beyond providing a connection between patients and specialized providers, telemedicine programs also promote exchange of knowledge between specialized doctors to improve decision-making by facilitating electronic transmission of patient-specific information and epidemiological information [19].

Trusting beliefs primarily from an Internet-based patient acceptance study. This research adapted the measurements from the above seminal studies. However, a field study was conducted with the subject experts from Bon Secours Baltimore Health System to strengthen the content validity and measurement applicability for the specific survey context [20]. Trusting beliefs means that one consider that the other party has one or more characteristics beneficial to oneself [21]. A new healthcare technology brings doubts about perceived self-efficacy, accessibility and support, perceived cost, and so on [22].

Research examines the factors that influence patient Telemedicine/Remote Health Care adoption drawing support from the Technology Acceptance Model. Basically TAM (Technology Acceptance Model) made up of two major dependent constructs i.e. perceived usefulness and perceived ease of use, also having an independent construct, named as behavioural intention [23]. Technology adoption alludes to an organization’s choice to attain an exceptional technology which is considered the best substitute available. In real meaning, technology adoption is concerning what technology to obtain and acquire. Therefore, a number of decisions are very much critical in the processes of technology adoption, along with technology acquirement approach and preferences of technology supplier and product evaluations of the technology in the areas i.e. safety, efficiency and ease of use have to be taken into account while making an adoption decision [24]. A particular telemedicine system might be implemented to ease the process of providers consulting with one another; an example of this type of system would be the POSC (Partners Online Specialty Consultations) program implemented by Brigham and The General Manager Hospital and Women’s Hospital, a website projected to facilitate provider conference [25]. In early 1990s when the Internet services were becoming reasonably priced, the notion of Telemedicine/Remote Health care in medical/

healthcare canters come into view and had provided massive benefits as a form of acceptable treatment due to the easiness for those patients who lived in rural parts of the United States [26]. Widening the technology acceptance models legitimate an assessment of the factors which prejudiced the acceptance/adoption and use of Telemedicine/Remote Health Care technology [27-28].

Not only have the technological possibilities burgeoned during the past decade, but the costs of technology also have steadily decreased, effectively making these technologies more accessible. Similarly, computer prices continue to fall steadily, and telecommunications expenses have decreased in many regions of the country as a result of the trend toward deregulation [29-30]. The cost of medical care can be reduced by telemedicine if it increases the likelihood of patients being treated by their local physicians in the local community health facilities. By enhancing the probability of care in rural areas, telemedicine can favourably affect the cost of medical care. Furthermore, telemedicine can contribute to retaining physicians in rural areas by reducing professional isolation.

Professional isolation experienced by rural physicians has been related to the: (1) lack of colleagues for referral, consultation and practice coverage; (2) lack of effective continuing medical education opportunities; and, lack of access to the latest medical information [31]. As per World Health Organization, ICTs have great potential to address some of the challenges faced by both developed and developing countries in providing accessible, cost-effective, high-quality health care services” [32]. Moreover, the use of sophisticated and very costly ICT equipment’s may not be a essentially a prerequisite for initiating a Telemedicine/Remote Health Care Management project in the developing country, since in developing countries satisfactory results can be achieved by applying low-cost Telemedicine/Remote Health Care projects [33].

According to literature, telemedicine faces some challenges in the developing world. The first and the biggest challenge is the cost as the technology involved is expensive, considerable amount of funding is required to initiate and run the programs. Most of the telemedicine projects in the developing countries fail to scale up, because of seizure of funding [34]. Mobile technologies are increasingly growing in developing countries like Pakistan. These days mobile (cell phone) is becoming an important ICT tool not only in urban areas other than in the remote/rural areas and trends are likely to increase by 2018 as well. Due to the swift progress in the technology sector, the ease of use along with the continuous decreasing expenditures of different devices, formulated the mobile (cell phone) a very suitable and more flexible device to overpass the digital divide. Cell phones possession within the Pakistan is increasing so quickly, the subscription of nearly six million new cell phones were added every month, also one in five Pakistani’s had possessed a cell phone at the end of the year 2011. Numerous of these new “cell phone citizens” spend their life in poorer and remote areas with inadequate transportation and any conveniences, lack of knowledge, low personal computer and internet access. Due to the accessibility of very low price cell phones and existing coverage of the GSM (Global System for Mobile Communications) networks within all over Pakistan is an enormous prospect for providing of the medical/health care services which would set off progress and will improve citizen’s lives.

As per the statistical report given by ITU, in the late 2006 total number of cell phone users in the worldwide were 2.7 billion, whereas there were only 1.1 billion number of Internet users. Which means that in the overall world population there exist 23.6% of the people out of which minimum of 22.2% belong to the developing countries have already cell phones but they are not so far using the Internet. Mobile phone services are rapidly

rising by widening the benefits of remote/rural delivery of government services and information to all those people who are unable to access public services through the Internet. With the help of the Mobile Devices, the Primary Health Care Services can be deliver more effectively and escort to less hospitalization [35]. The Implementation type contains of (a) store and forward method which initially stores all reports, medical images or any other data related to patients for fixed time period, forwards this data to concerned doctor when he becomes available [36]. The interactive services between the health care provider and patient can only be put into operation where sufficient network resources are accessible. It provides services like physical examination, psychiatric evaluations and assessments. Interactive service provides same level of comfort just physically present with the doctor. Moreover interactive services are implemented in ambulances where the paramedical staff and patients are consistently monitored and directed by doctors [37].

The Existing structure of healthcare facilities include major Teaching Hospitals, DHQ (District Headquarter Hospitals), BHU (Basic Health Units), THQ (Tehsil Headquarter Hospitals) and RHC (Rural Health Centers), divided into three sections i.e. primary, secondary and tertiary services. This concept was developed in the seventh five years plan from 1988-1993. The main objective was to have a comprehensive health care services standard. Though this architecture is highly adoptable and effectual but the main problem is that specialist doctors are not enthusiastic to serve in THQ's and RHC, whereas few agrees to serve in DHQ and most of consultants, physicians and surgeons like to serve in teaching hospitals. Furthermore, providing equipments and machineries for medical test and trained staff at such large scale is near to impossible. Besides, basic fault with this architecture is that RHC, BHU and DHQ are

usually located far away from each other thus giving rise to distance factor [38]. According to Rogove and Herbert the resistance in adoptability of novel approaches in Telemedicine like, acceptance and maintenance of robotic Telemedicine is discussed [39]. Keprvides literature review to scrutinize patient management in secondary care by doctors from multiple disciplines, primarily economic assessment was executed using Consensus on Health Economic Criteria [40]. The research sources of telemedicine database from difference sources" the role of telemedicine is most significant for the health care management applications [41].

1.5 Hypotheses

- H1:** There is a significant impact of **adoption of innovation** on remote health care management system.
- H2:** There is a significant impact of available **speciality knowledge** on remote health care management system.
- H3:** There is a significant impact of **trusting beliefs and self-efficacy** on remote health care management system.
- H4:** There is a significant impact of **perceived ease of use** on remote health care management system.
- H5:** There is a significant impact of **cost of technology** on remote health care management system.
- H6:** There is a significant impact of **financial feasibility** on remote health care management system.
- H7:** There is a significant impact of **patient acceptance** on remote health care management system.

1.6 Research Methodology

The Participants of this study were 160 professional doctors working in seven different public/private sector hospitals of Islamabad, Pakistan. Convenience sampling has been used. A questionnaire was developed to validate the research hypotheses. Total 40 questions were asked in provided questionnaire about independent and dependent variables 0.5 point Likert scale was used.

2. MATERIALS AND METHOD

Structures questionnaire has been used to gather data from 160 medical professionals in public and private sector hospitals in Islamabad- Pakistan. SPSS 20 has been used for statistical calculations. On the basis of perceptions and experience of doctors involved in hospitals operations: it had been observed that effective implementation of EM practices will enable the hospitals (management) to become more productive and efficient. Public/private hospitals in Pakistan should focus on the findings of this research and take serious initiatives to encourage top management to relook at remote health care practices (system) properly and efficiently.

3. RESULTS AND DISCUSSION

The range of the “alpha coefficient” lies from 0-1 which could be used to explain the reliability of factors taken out from dichotomous i.e. questions asked having two possible options of answers or multi-point designed questionnaires/scales. The rating of the questions is 1 for Strongly Agree and 5 for Strongly Disagree as shown in Table 1. There were seven independent variables along with one dependent variables based on the literature review which was used for the calculation of the relationship between independent variables and dependent variables as shown in Fig. 1.

Cronbach’s Alpha value for overall reliability is 0.665 which proves that the data is reliables variables as shown

in Table 2. Descriptive statistics deal with the concepts and methods concerned with summarization and explanation of the important aspects of the statistical data.

The results presented in Table2 are from the two normality standard tests i.e. Kolmogorov-Smirnov and the Shapiro-Wilk Testas shown in Table 3. For small sample sizes i.e. < 50 samples, the Shapiro-Wilk test is more suitable but this test is also accurate for the sample sizes up to 2000. On this basis, the researcher used the Shapiro-Wilk test (as my numerical way to assess the normality. In this research study as the respondents

TABLE 1. MULTI-POINT FORMATTED QUESTIONNAIRES OR SCALES

Scale	Description
1	Strongly Agree
2	Agree
3	Neutral
4	Disagree
5	Strongly Disagree

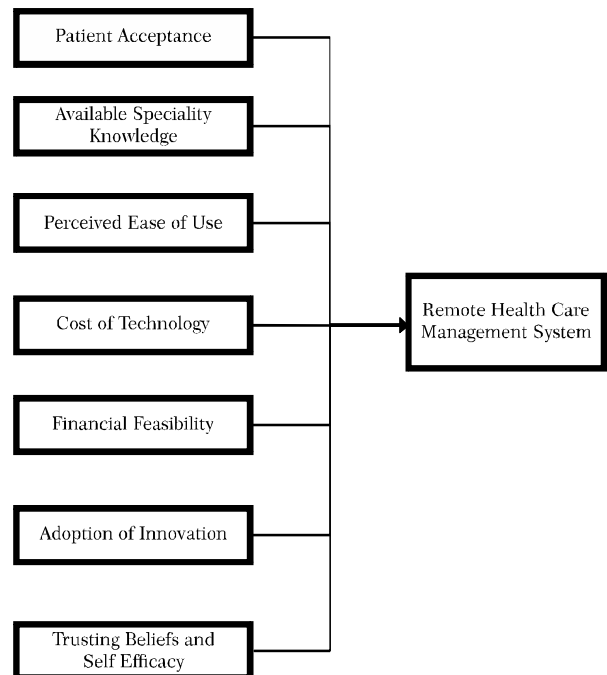


FIG. 1. RESEARCH FRAMEWORK

are only 160, the Shapiro-Wilk test has been used. As the p-value is 0.000 as shown in Table 4, therefore all alternative hypotheses have been accepted and by concluding that all the research data comes from the normal distribution. The study used different SPSS tools to calculate the effectiveness of telemedicine applications in Pakistan. After the analysis of data it was evident that all the variables for successful execution were being fulfilled.

3.1 Research Model

Regression model is presented as follows:

$$Y = \alpha + \beta_1(x_1) + \beta_2(x_2) + \beta_3(x_3) + \beta_4(x_4) + \beta_5(x_5) + \beta_6(x_6) + \beta_7(x_7) + \epsilon \quad (1)$$

TABLE 2. RELIABILITY SCALE- CRONBACH'S ALPHA/ DESCRIPTIVE STATISTICS

Variables	No. of Items	Cronbach's Alpha
V1	5	0.754
V2	5	0.735
V3	5	0.629
V4	5	0.701
V5	5	0.612
V6	5	0.633
V7	5	0.655
DV	5	0.601
Overall	40	0.665

$$DV = \alpha + \beta_1(V_1) + \beta_2(V_2) + \beta_3(V_3) + \beta_4(V_4) + \beta_5(V_5) + \beta_6(V_6) + \beta_7(V_7) + \epsilon \quad (2)$$

Where X1= V1, X2= V2, X3= V3, X4= V4, X5= V6, X6= V6, X7= V7 and ε = error term

R: 74.5% correlation coefficient between all the predictors (independent variables) and the dependent variable. **R²:** 55.5% proportion of variance in the dependent variable predictable by The predictable variables adjusted **R²:** 55.1% dependent on the number of variables used in the equations as shown in Table 5.

All independent variables i.e. V1 (Beta 0.428, t 5.650), V2 (B 0.586, t 6.706), V3(B 0.197, t 2.868) V4 (B 0.71, t 1.223) V5 (B 0.141, t 2.272) V6 (B 0.258, t 2.333) and V7 (0.325, t 4.255) showing positive trend against DV as shown in Tables 6-7.

TABLE 3. KOLMOGOROV-SMIMOV AND SHAPIRO WILK TEST IN SPSS

	Cases					
	Valid		Missing		Total	
	N	%	N	%	N	%
Data	160	100	0	0	160	100

TABLE 4. TESTS OF NORMALITY

	Kolmogorov-Smimov			Shapiro-Wilk		
	Statistics	df	Significant	Stats	df	Significant
Data	0.137	160	-	0.946	160	0.000

TABLE 5. MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.745a	0.555	0.551	0.21912

TABLE 6. ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Significant
1	Regression	8.884	7	1.481	55.052	0.000b
	Residual	2.770	152	0.027	NA	NA
	Total	11.654	159	NA	NA	NA

TABLE 7. COEFFICIENTS

Model	Unstandardized Coefficients		Standardized Coefficients	T	Significant
	B	Standard Error	Beta		
(Constant)	0.566	0.273		2.075	0.041
V1	0.454	0.080	0.428	5.650	0.000
V2	0.619	0.092	0.586	6.706	0.000
V3	0.206	0.072	0.197	2.868	0.005
V4	0.051	0.042	0.071	1.223	0.224
V5	0.145	0.064	0.141	2.272	0.025
V6	0.258	0.077	0.114	2.333	0.006
V7	0.325	0.087	0.128	4.255	0.005

4. CONCLUSIONS

Telemedicine is unpopular or new in Pakistan but where it is applied, it's being applied effectively. It does add benefits and convenience to lives of people living in remote areas as well as to those living in big cities. In future telemedicine is predicted to grow and provide healthcare facilities to areas of Pakistan that are still deprived of them. Telemedicine applications are thus running effectively in Pakistan. It was also noticed that due to lack of expertise and experience, the effectiveness level, though acceptable, is not very high. Some shortcomings are identified in this regard that needs to be addressed for more successful proceedings.

A slight level of disagreement was also observed in the study. Some of practitioners were reluctant to accept telemedicine as major usable and suggested phenomenon that it was not a proper way for medical consultation. They accentuated that both parties i.e. doctor and patient should be physically present at the same place, only then can a successful consultation take place. However literature and data suggests otherwise. Many patients are treated successfully via telemedicine across the globe on daily basis. These responses of the doctors might have occurred due to reluctance in accepting change. It

happens often when new technology is acquired by organizations/hospitals as a whole, the human resource opposes the acquisition in fear of job security. However most of the doctors have high hopes regarding telemedicine and they support the idea strongly.

Telemedicine does hold a good future in Pakistan as indicated by the data, but it will not gain popularity in near future. It will take some time for the activities to develop and be common. This is so because telemedicine was recently introduced in Pakistan unlike other developing nations who adopted it in late 1990's. In Pakistan the practice started almost a decade later in 2008. After that investments will be attracted and only then can the subject prevail in its true sense. However potentially it is a very strong area with a number of benefits supporting the idea.

5. RECOMMENDATIONS

A lot needs to be done for telemedicine in Pakistan. A number of shortcomings were identified by the study and for them some solutions have been recommended. For a successful future of telemedicine these recommendations need to be implemented. Some of the suggestions can only be implemented by the government.

- (i) First of all the level of existing program shall be improved. This can be done by giving proper training to all the personnel who participate in telemedicine activity. This will help raise the level of aptitude of the staff and will also reduce the reluctance that doctors have in accepting the impending change.
- (ii) Alternate energy sources shall be provided to the existing remote stations. It is difficult and expensive to do so, thus smaller sources may be provided that can only power the ICT equipment so that tele-medical consultations may take place uninterrupted.
- (iii) Awareness shall be spread regarding the subject. General public as well as businessmen, doctors and students shall be introduced with the idea. This will create a need and pathways will be developed for the business. Also, innovations will be made by those who are related to the subject. It can be done via print and electronic media through advertisements and documentaries.
- (iv) Subjects related to medical technology have been introduced in the curriculum of degree in MBBS. Nowadays many subjects regarding newly introduced technologies are being taught in other countries e.g. health informatics, HMIS. Post graduate programs in Telemedicine are being introduced nowadays. HEC also has launched programs for Bio Medical Engineering and other related courses in undergraduate level. Due to the inclusion of these programs the capital of the country is being saved in these days due to not spending on expensive trainings and workshops.
- (v) The government already has health provision centres in many of small villages and towns. Some of them are small hospitals and those in backward areas are dispensaries. The government shall

start with the existing system so that cost can be saved. Only telecommunication network is needed to be installed. After that, new centres may be developed as per requirement.

- (vi) Investors shall be encouraged and attracted towards the field so that development can take place in private sector also. This can be done by highlighting the subject and spreading word for the need and importance of telemedicine for people of Pakistan. Incentives can be awarded on satellite communication to increase interests of potential investors.
- (vii) Armed forces have a huge network of hospitals in Pakistan. Many of their units reside in smaller cantonments, situated in small towns. As for army, forces are always at borders and other operational areas. So a large telemedicine network can be established if the „Combined Military hospitals serve as tertiary care units and provide Tele-medical consultations to the smaller healthcare units in small cities and base camps. Satellite link will be needed to setup, other requirements are at hand already.

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