Telemedicine Utilization Under The ISRO Telemedicine Project In Karnataka Focusing On Physician And Telemedicine Center Characteristics

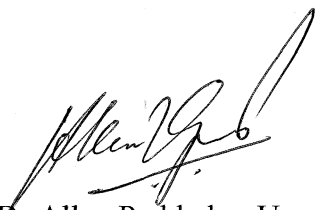
Dr. Allen Prabhaker Ugargol

Dissertation submitted in partial fulfillment of the requirements for the award of the degree of Master of Public Health

Achutha Menon Centre for Health Science Studies
Sree Chitra Tirunal Institute for Medical Sciences and Technology
Thiruvananthapuram
October 2007

Declaration

I hereby certify that the work embodied in this dissertation entitled "***Telemedicine utilization under the ISRO Telemedicine Project in Karnataka focusing on physician and telemedicine center characteristics***" is the result of original research and has not been submitted for any degree in any other University or Institution.



Thiruvananthapuram

October 2007

Dr Allen Prabhaker Ugargol

Acknowledgements

At this juncture, I fondly remember all those who have been a part of this fruitful journey, especially every respondent in my interviews who spared time and facilitated the study.

I am very grateful to my dissertation guide, Dr Kannan Srinivasan, Associate Professor, AMCHSS, who was highly encouraging, more of a friend and mentor than a guide and who took personal pains to guide me through this research work. I am also indebted to Dr. Biju Soman, Assistant Professor, AMCHSS who was instrumental in the conceptualization of the topic and tools for the study; Mr. LS Satyamurthy, Head, ANTRIX, ISRO and Dr. RLN Murthy who permitted and encouraged the study. I am also thankful to Mr. Basavaraju, IAS (Commissioner) and Dr. S. Prakash, Joint Director (Medical), DHFWS, Government of Karnataka who encouraged me and provided written permission to visit all government telemedicine facilities.

I would like to thank Dr. K. Mohandas, Director; Dr K R Thankappan, Professor and Head, AMCHSS; and all the inspiring faculty - Dr. K Sundari Ravindran, Honorary Professor, Dr. V Raman Kutty, Professor, Dr. Mala Ramanathan, Additional Professor, Dr. P Shankara Sarma, Additional Professor, Dr. Manju Nair, my course coordinator, and Dr. Richard A Cash, Visiting Professor, Harvard School of Public Health for their constructive criticisms and suggestions from conceptualization and up until completion. I am also grateful to Mr. Sundar Jayasingh, Assistant Registrar, for his encouragement and administrative support.

Last, but not least, I fondly acknowledge my family back in Bangalore who have shared in my zest and supported me completely.

Thiruvanathapuram

Dr. Allen Prabhaker Ugargol

Certificate

I hereby certify that the work embodied in this dissertation entitled *"**Telemedicine utilization under the ISRO Telemedicine Project in Karnataka focusing on physician and telemedicine center characteristics**"* is a bonafide record of original research work undertaken by Dr Allen Prabhaker Ugargol, in partial fulfillment of the requirements for the award of the "Master of Public Health" degree under my guidance and supervision.

K. Srinivasan

Dr Kannan Srinivasan, PhD

Associate Professor,

Achutha Menon Centre for Health Science Studies,

Sree Chitra Tirunal Institute for Medical Sciences & Technology,

Thiruvananthapuram - 695011

October 2007

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LIST OF ABBREVIATIONS

AMCHSS	**Achutha Menon Centre for Health Science Studies**
CME	**Continuing Medical Education**
DH	**District Hospital**
DIT	**Department of Information Technology**
EMR	**Electronic Medical Records**
ICT	**Information and Communication Technology**
ISDN	**Integrated Services Digital Network**
ISRO	**Indian Space Research Organization**
IT	**Information Technology**
MCIT	**Ministry of Communications and Information Technology**
NGO	**Non-governmental Organization**
PHC	**Primary Health Center**
PIR	**Patient Information Record**
SCTIMST	**Sree Chitra Tirunal Institute for Medical Sciences and Technology**
TCC	**Telemedicine Consulting Center**
TH	**Taluk Hospital**
TM	**Telemedicine**
TSC	**Telemedicine Specialty Center**
TSP	**Telemedicine Service Provider**
VRC	**Village Resource Center**
VSAT	**Very Small Aperture Terminal**

ABSTRACT

"Telemedicine utilization under the ISRO Telemedicine Project in Karnataka focusing on physician and telemedicine center characteristics"

Rationale:
India faces a rural-urban healthcare access divide. As a technological solution, telemedicine has the potential to bridge this divide by providing specialist physician consultations to remote populations. Various telemedicine initiatives are now operational in India offering healthcare access to remote and rural populations including the ISRO telemedicine project in Karnataka. However, the utilization of telemedicine has not been very encouraging. Since physicians are the main users of telemedicine, it becomes important to study the characteristics of physicians and of the associated technicians and administrators at both the remote and specialty end centers and their influence on actual utilization of the facility. The other important element in the utilization of telemedicine is the setup in which it operates. This includes organizational factors such as the type of center, structure, function, etc. A combination of individual and setup factors influence utilization. However, not many efforts have been made in studying the utilization of telemedicine in India and none have looked at physician and center characteristics in particular. The lacunae in this field of health research provides an opportunity to study the utilization of telemedicine in India by selecting a large, multi-centric, functional ISRO telemedicine project in the southern state of Karnataka, India.

Objectives:
To study the telemedicine utilization by physicians under the ISRO Telemedicine Project in Karnataka. Specifically, to explore the linkages between 'physician' characteristics and utilization of telemedicine and the linkages between 'telemedicine center' characteristics and utilization of telemedicine.

Methodology:
A descriptive study of all the 19 Telemedicine Centers (Government and Private; Telemedicine Specialty Center (TSC) and Telemedicine Consulting Center (TCC)) supported by the ISRO-Telemedicine Project across the length and breadth of Karnataka. Between June 15, 2007 and September 15, 2007, 45 interviews were conducted (17 physicians, 11 administrators and 17 technicians), facility checklist entered along with review of the tele-health log book at every center. The reference month for all data collected is July 2007.

Results:
Nearly 60 percent of the TM centers were sub-optimally utilizing telemedicine facilities (<20 consultations/month). Only 29 percent of physicians who were aware of the uses of telemedicine were optimally utilizing. All centers that had more than 3 technicians at their facility were seen to be optimally utilizing telemedicine facilities whereas only 35.3 percent of facilities with less than 2 technicians were able to optimize utilization. Nearly 29 percent TCC physicians who had a positive attitude towards the use of telemedicine ended up optimally utilizing telemedicine facilities. Half of those physicians who expressed a high need for incentives were optimally utilizing the facility. Only 14.3 percent of TCC physicians who consulted based on patient needs were optimally utilizing telemedicine. Nearly 17 percent of physicians who expressed high satisfaction with telemedicine consultations had optimally utilized the facility. Around 18 percent of physicians who were personally acquainted with TSC specialty physicians had optimally utilized telemedicine compared to none who had no personal acquaintances. All centers which had 4 to 6 physicians to attend were optimally utilizing compared to 35 percent of centers which had less than 3 physicians at their disposal. Organizational characteristics of the center, manpower shortage and connectivity issues were influencing utilization.

Conclusions:
A large proportion of TCC's and TSC's were 'below optimally' utilizing telemedicine. Physician characteristics that influenced utilization included awareness, physician attitude, need for incentives, satisfaction with the consultation, highest education, training and rapport with other physicians. At the center level, staffing issues, inability to ensure proper scheduling of duties for physicians, lack of incentives, poor technical support and connectivity were issues that influenced utilization and hence need addressing. The findings of this study suggest the need to appoint designated staff, train staff continuously, update and maintain equipment regularly, and to identify common interests between referring and consulting sites to make telemedicine sustainable. Hopefully, the findings of this study will serve as a catalyst for larger studies, thereby overcoming the obvious limitation of a small study such as this one.

CHAPTER 1 INTRODUCTION

"Telemedicine utilization under the ISRO Telemedicine Project in Karnataka focusing on physician and telemedicine center characteristics"

1.1. BACKGROUND

Even as we settle into the 21st century, the way we live is hurriedly changing due to the sudden evolution of information and communication technologies (ICT). It is evident that health care across the globe is transforming, and access, adoption, acceptance and the use of ICT are gaining momentum due to recent advances in information systems and e-health technologies. These technologies have the potential to change the practice of healthcare delivery and can alter the nature and practice of doctor-patient relationships thus bringing in new challenges for the medical profession. To prepare for these changes, the onus is now on health care providers to be able to utilize existing and emerging ICTs.(1)

Although it still lags behind all other industrial applications, the use of ICT in health has increased and the general administration of many hospitals and healthcare providers are now computerised. Hospital information systems, the internet, telemedicine, personal digital assistants, electronic patient records and other applications are inevitably becoming routine in health. (2) However, it has often been felt that the health providers, the main users, are not yet fully prepared to welcome the resource of ICT. (3-8) The term 'telemedicine' encompasses a wide range of telecommunications and information technologies and many clinical applications, although video conferencing may be the most common medium. Even though telemedicine programs began almost 40 years ago, the technology has grown considerably only in the last decade. Despite the omnipresence of telemedicine, the volume of patients receiving services that use the technology remains relatively low. User acceptance issues have continued to be an important factor as the use of ICT continues to penetrate the

health sector. In a recent report on Australia's proposed National Health Information Network, Health Connect, the need to increase understanding of acceptance in order to overcome issues hindering ICT adoption and in ensuring successful utilization were highlighted.(9)

Most research on information technology in health has painfully compiled the reasons for barriers to using ICT within health, however, there is still a paucity of scientifically rigorous research on acceptance and utilisation of ICT within health.(10) Physicians have been identified as the most important users of telemedicine technology and their acceptance has shown to have a positive impact on a program's ultimate success. The telemedicine literature has attributed many program failures to lack of physician acceptance of technology. At the dawn of large-scale telemedicine implementation in India and elsewhere, it is paramount to address the physician technology acceptance issue.

1.1.1 BACKGROUND AND AIMS OF THE ISRO TELEMEDICINE PROJECT

The Indian Space Research Organisation (ISRO) started the Telemedicine Program in the year 2001 with the following goals and plans. In terms of technology, this is state-of-the-art and unique and the Multi-Specialty Network consists of a pool of specialty hospitals which provide telemedicine service to various district hospitals (DH)/taluk hospitals (TH). The main intention of this project is to provide expert consultation to the needy and underserved population in India. In the near future, ISRO plans to connect many of the Primary Health Centers (PHC's) to this network and further reach out to people and communities across the country.

GOALS:

- To make Telemedicine (TM) enter the mainstream of healthcare delivery
- To define a National TM Grid and consider its standards and operational aspects

- To identify and evaluate all players and projects currently involved in TM in India
- To prepare a National Cancer TM Network
- To define standards and structures of EMR and patient data base
- To draft a National Policy on TM and CME and to prepare a Central Scheme for the 11th Five Year Plan.

PURPOSE:

- Providing Telemedicine to the un-served and the under-served populations.
- Set up Telemedicine Facilities in distant and rural parts of India to supplement the general healthcare infrastructure.
- Part of 'proof of concept technology demonstration' program.
- The Telemedicine facility connects the District Hospitals/Health Centers with Super Specialty Hospitals for providing expert consultation to the needy and underserved population

OUTPUTS:

- Tele-consultation and treatment through telemedicine and continuing training of doctors and paramedics
- Continuing medical education through telemedicine
- Rural health camps, especially in the fields of ophthalmology and community health
- Disaster management support and relief through telemedicine

ACTIVITIES:

- Providing telemedicine technology and connectivity between remote/rural hospitals and super specialty hospitals
- Providing technology and connectivity between medical colleges and postgraduate medical institutions/hospitals
- Providing technology and connectivity for mobile telemedicine units

- Providing technology and connectivity for Mobile Telemedicine units for rural health camps especially in the areas of ophthalmology and community health
- Providing technology and connectivity for disaster management support and relief
- Integrating with Village Resource Centers (VRC) / Information kiosks for multiple services to the community.

Elements of the ISRO Telemedicine Network

1. The Patient End (TCC)
2. The Specialty End (TSC)
3. The Communication Link (ISDN or VSAT connectivity)

The objective of any telemedicine system is 'consultation'. Therefore, it needs two terminals – one that seeks consultation (the patient end) and the other that provides consultations (the specialty end). Telemedicine system prepares an electronic file of the patient records at the patient end and transfers it through a communication link to the specialist end, where a specialist opens the file, examines the records and gives his diagnosis and recommended line of treatment. The communication link is the pipeline through which the sources of information are conveyed up and down the centers.

In Karnataka, ISRO implemented the Telemedicine Project-Operational Phase in 2002 with the aim to bring multi-specialty healthcare to a significant section of the rural population of Karnataka. It involved designating specialist centers (TSCs) and identifying remote centers (TCCs) and providing equipment, technology and connectivity to enable tele-consultation and CME's between these centers.

1.2 OBJECTIVES OF THE STUDY

1.2.1 Major Objective:

To study the telemedicine utilization by physicians under the ISRO Telemedicine Project in Karnataka

1.2.2 Specific Objectives:

(i) To explore the linkages between 'physician' characteristics and utilization of telemedicine.

(ii) To explore the linkages between 'telemedicine center' characteristics and utilization of telemedicine.

1.3 REVIEW OF LITERATURE:

Telemedicine: introduction and realities

Healthcare organizations have been using telemedicine technologies to provide services to isolated areas and allow information and knowledge exchange between specialists and local physicians. (11) However, the expected benefits of telemedicine technology with respect to healthcare access, quality, and continuity were not materializing in the absence of its integration into routine clinical practice.(12,13) Since physicians form the main users of telemedicine; their acceptance of this technology poses a major challenge for the functioning and sustainability of telemedicine networks. Further, the introduction of telemedicine was seen to obliterate the walls between healthcare organizations and leading to re-drawing of professional roles.(14-16) Hence, the implementation of a telemedicine program and its success depends on the combination of several factors. Some studies which looked at the individual level have investigated the psychosocial determinants of telemedicine adoption by physicians.(17,18) Chau and Hu (1999) proposed a hierarchical model of telemedicine acceptance that included parameters at the individual, technological, and organisational levels. (19) In this particular model, variables at the organization level were related to the

influence on physicians' decision to accept telemedicine and on the compatibility of the introduced technology with the physicians' routine clinical work.

Satisfaction among providers

In most of telemedicine research, defining satisfaction has been a difficult issue.(20) Since satisfaction does remain an integral part of healthcare quality, feelings of satisfaction are difficult to understand and require multiple inputs, beginning with the provider. Satisfaction, which is usually defined as when an individual's expectations of treatment and care are met, is only one of descriptions found in telemedicine research.(22) Many large studies have examined barriers to care, outcomes, and cost as important variables affecting utilization of telemedicine.(23-27) Satisfaction, again needs special attention because it is a critical aspect of quality of care and health outcomes.(28, 29) The application of telemedicine technology and the satisfaction of the user have been looked at from different areas of use such as primary care, emergency care, surgery, dermatology, oncology, physical rehabilitation, pediatrics, obstetrics, psychology, and radiology, etc.(30-41).

Research methodologies used in studying telemedicine utilization

Although various studies have used different methodologies, a majority of the research consists of quantitative research done using questionnaires.(42-45) A few studies have adopted qualitative methods and triangulation to bring out new and richer perspectives on telemedicine.(46-50) The most common area in satisfaction research thus far has been to study the perceptions of patients, however, these studies have missed exploring the satisfaction of the physicians per se. Telemedicine researchers these days are incorporating additional theories and tools, and research teams are becoming truly interdisciplinary.(51) Some of the early work in telemedicine research done in the nineties from the provider perspective focused on the potential of the new technology and expressed enthusiasm.(52)

Recent studies however still highlight this potential but are slowly shifting into examining why some providers seem to resist technological advancements.(53) Similar to patients, providers express positive satisfaction, but their acceptance tends to be more cautious.(54)

Providers in telemedicine

In studying different applications of telemedicine, providers welcomed a few attributes of telemedicine, particularly the opportunity to speed up patient referrals.(55) Even in applications dealing with electronic medical records, physicians appreciated the ability to view high quality diagnostic images and provide specialist opinions.(56) A major attribute for medical professionals was the capacity to consult on surgeries without having to travel to the remote center.(57) By tele-consulting and participating in discussions, these providers attained a diagnostic accuracy rate of 95 percent. Gilmour et al in their study have reported that 75 percent of providers found telemedicine sessions to be of educational benefit apart from the ability to diagnose and manage cases remotely.(58)

Interaction between providers at remote and specialist centers

Among the other factors which influenced providers' opinions, the competency of the practitioner on the other end of the system and the accuracy of the patient records were important for providers.(59) Mutual trust among healthcare workers influenced and directly affected their attitudes toward the telemedicine center.(60) Physicians also appreciated the learning opportunities of tele-consultations, as well as the potential to reduce unnecessary specialist referrals. As specialists obtained details of the patient in advance, they were in a position to make early decisions about the need for hospital visits.(61)
It has been documented that management and administrative opinions have the potential to affect providers' thoughts about telemedicine. Supervisors who failed to realize the potential of the application made it difficult for healthcare workers to utilize telemedicine.(62)

TAM in telemedicine research

The Technology Adaptation Model, first used by Davis, has been used in health care too. It consists of two components namely - 'perceived ease of use' and 'perceived usefulness'. Chau and Hu (2002) explored the acceptance of telemedicine technology amongst 408 physicians by examining Davis' Technology Acceptance Model with other known models. Healthcare professionals surprisingly exhibited a lot of basic differences from business users and students (commonly used subjects in other technology acceptance studies) in their technology acceptance decisions. (63-65) A much modified version of the original TAM was also used to test IT adoption by 101 family physicians by Dixon and Stewart (2000), but the reported results were poorly linked to the components of TAM. As the use of ICT across the health sector is increasing, the capacity to identify, predict and manage physicians' acceptance of technology will be important in implementation as the acceptance of ICT by users is vital for its ultimate success. (66, 67) There is also the need arising from health informatics literature for increased knowledge and research on information and telecommunication technologies. (68-70) Most of the health care providers who used telemedicine had been satisfied with it as a method of health care delivery and there is growing literature of provider satisfaction studies investigating this concept. Many studies have also looked at the issue of physician satisfaction from different perspectives including referring physician satisfaction, consulting physician satisfaction, satisfaction with the equipment, and satisfaction with patient consultation.(71)

Factors affecting success of telemedicine programs

A thorough understanding of how many physicians are present, kinds of physicians and the capabilities of each facility has been known to make telemedicine planning easier. Another important clinical factor found in literature was whether the remote site physicians could handle the follow-up care for a given health delivery. (72) Most successful telemedicine

programs strive hard to make telemedicine complementary and integrated at the remote facility rather than competing with the existing health care services being offered. It has been found that positive relationship and rapport between the remote and consulting site are possible if patients are not weaned away by the specialty center.(73) In framing a telemedicine program, remote site physicians, nurses, technicians, and hospital administrators need to be consulted about their needs and expectations. (74) As the success of a telemedicine program is measured by the number of tele-consults that initiate from remote centers, it is vital to ensure that remote site staff feel involved in the program. Physicians who are not so familiar with telemedicine and are uninterested would result in little benefit to patients and negatively affect the telemedicine program. (75) The framework has suggested that providers benefit from utilizing telemedicine. (76-78) Primary care physicians were able to learn more about specialty care by being involved in the telemedicine consultation. Physicians were able to participate in professional discussions, fulfill continuing medical education requirements, engage in administrative meetings, and also conduct quality reviews.(79) Telemedicine also reduced travel time between clinics or to and from educational institutions and therefore allowed physicians more time to see patients and reduced waiting times. Travel costs for the physician were reduced by the physicians' ability to fulfill professional and educational engagements through teleconferencing.(80) It was also seen that telemedicine for specialist consultation was cost-effective for organizations that were tuned in to new technology and did improve the continuity of care for patients.(81-82)

Benefits of telemedicine

In telemedicine literature, there exist several examples of the benefits of telemedicine to patients and providers.(83) It has been found that by increasing access to specialty expertise, telemedicine can support a hospital in an area that had limited access to comprehensive healthcare. Telemedicine can promote increased coordination between the primary care

physicians and specialists in treatment decision making and allows primary care providers to directly engage in the management of patients. Telemedicine also provides a learning experience to the rural primary care providers and reduces provider isolation. Telemedicine decreases travel and loss of work hours for patients/guardians/family and also can reduce the chance of medical errors as there is good discussion between the specialist and primary care provider. Telemedicine places patients under the care of their primary care physicians and improves patient and parent/guardian perception of their provider.(84)

Center characteristics

Very little research has so far been done to understand the impact of hospitals' characteristics on telemedicine adoption from an organisational perspective.(85) The existing literature points out that the availability of in-center technical support, presence of telemedicine leaders in the hospital, and the management of change at the individual and organisational levels were facilitators for telemedicine integration into the system. Moreover, it was stated that those telemedicine networks that respected each of the involved organizations' capacities were more likely to work cohesively. (86) According to Whitten and Allen (1996), the principal factors of success of a telemedicine program were listed as – state funding of the program, active promotion of telemedicine in organizations and the presence of facilitating administrative setup. Conversely, other factors, such as the lack of a motivated leadership and problems with services reimbursement seem to be bottlenecks in the smooth integration of telemedicine. (87)

Facilitating and limiting factors

The commitment of the telemedicine leader, technical and logistical support from the organization along with autonomy and self-sustainability were found to be positive conditions for success. Lack of financing, technical problems and manpower shortages were

listed as the principal factors limiting the success of a telemedicine program according to Fortin et al, 200. It was also indicated that a telemedicine program that is based on the needs of the remote hospital and respects the simultaneous operation of existing healthcare services is more likely to be successful.(89) In the study by Sicotte and collaborators (1999), factors related to organizations such as the administrative setup and the existence of expertise in remote centers had limited telemedicine utilization. Geographical distance between the remote and specialty hospital was also seen to contribute to greater telemedicine utilization.(90) Among the theoretical models used to explore organizational characteristics influencing technology adoption, Mintzberg's configuration theory (1979) and institutional theory (DiMaggio and Powell, 1983; Meyer and Rowan, 1977) provide concepts to analyze the relationship between hospitals' administrative structures and the process of telemedicine integration into the system. (91-93)

Role of the organization and administrative setup

Kimberly and Evanisko (1981) used a multidimensional model to look into factors influencing administrative roles and technology adoption by hospitals. Autonomy, specialization, organization's size and functional variety were having positive correlations with adoption of technology. (94) In a few qualitative studies - the individual, professional and organisational factors that influenced uptake of a hospital information system were looked at. This can be taken as being similar to telemedicine uptake. The lack of technical manpower and financing issues had a negative influence on adoption. (95, 96) Damanpour (1991) suggests that specialization, vertical differentiation, and managerial attitude towards change were positively associated with telemedicine utilization. (97)

Telemedicine and the art of medicine

Perhaps one of the biggest obstacles to telemedicine utilization is the decrease in the "art" of medical care provision. Telemedicine throws up a debate on 'technology' versus 'touch' care.

Because of the lack of physician presence, patients and their families may feel left out of participating in the consultation. Some of the simplicity and relaxedness of the patient-physician interaction may also be lost. Subtle aspects of the interaction such as personal concern for the patient, identification with the patient's concerns, and warmth and friendliness would be absent.(98) Telemedicine will force physicians to improvise in communicating with patients in such as way that the warmth of the doctor-patient relationship is maintained to ensure compliance and well-being of the patient.(99)

Future potential and need for addressing barriers

Telemedicine may emerge as an important aspect of medicine and health care delivery in the future, and physicians may have to become aware of the various aspects of its use. Physicians shall have to be instrumental in framing telemedicine standards that will protect patients and improve access to care. Thus, it is vital that physicians imbibe everything they can about the technology, how to access it, and how to use it, etc. On the other hand, physicians and other associated staff need to ensure that this new technology only enhances and does not impede the provision of quality care. (100) Prasad and Prasad (1994) have emphasized the influence of professional behavior on the adoption of information technology by healthcare professionals. They ascribe that telemedicine adoption is not only influenced by factors such as efficiency, performance, and profitability but other non-quantitative factors such as symbolic, cultural and political aspects play and important role. (101) Telemedicine programs that reported higher utilization had adequate staff available to operate and maintain the equipment and regular technical support. Also, the rapport between administrators and physicians and between consulting sites and their associated referring sites was good in such programs. (114)

1.4 RATIONALE FOR THE STUDY:

In a developing country such as India, there exists huge inequality in health-care distribution and access. Although a large proportion of the population lives in rural areas, more of the health facilities are concentrated in the cities.(102) A majority of the population lacks access to basic health care facilities.(103) In India, the government spends around 0.9 percent of the country's annual gross domestic product on health. (104, 105) In addition, rural populations spend most of their out-of-pocket health expenses on travel to the specialty hospitals in the city and other associated expenses.(106, 107) Telemedicine, with its reach and capability can turn out to be the most economical and quick means of bridging this rural–urban health divide. Complemented with India's huge strides in the field of information and communication technology, telemedicine can offer specialized healthcare to the remotest corners of the country.(108, 109)

Physicians are notably the most important users of telemedicine and their acceptance and utilization of technology can have an important impact on a telemedicine program's success. Telemedicine literature has blamed many program failures on the lack of technology acceptance by physicians. In many cases, the physician's decision to use or not to use is completely left to his/her discretion. Today, when there is large scale implementation of telemedicine programs across India, it is so important to explore the physician technology acceptance issue. Providers seem to be lukewarm in their acceptance of telemedicine technology. Awareness of the technology, training in using the equipment, satisfaction with the quality of consultation and ease of use were important factors affecting physicians' utilization of telemedicine. Improved explanation of telemedicine, its use and equipment can help physicians gain confidence in the activity and promote utilization. Even telecommunication equipment-makers need to think of what doctors expect form technology and strive to make user-friendly products. (110, 111) A study into what are the factors that

influence a physician to utilize or not to utilize telemedicine facilities is warranted at this juncture.

Secondly, thus far, very little research has been done to understand the impact of health setup characteristics on telemedicine utilization from an organizational perspective. Few studies done across the world have looked into setup characteristics associated with telemedicine utilization and found that the availability of technical support, the presence of committed telemedicine champions and good administrative handling at the individual and organisational levels were facilitators for telemedicine utilization optimization.(110, 111) It was also found that centers which took into consideration the characteristics of the consulting centers were more likely to utilize more.(112) Conversely, the lack of financial support, lack of technical manpower, inadequate staffing and other human resource issues were identified as the principal barriers to optimal utilization of telemedicine. (113) There is paucity of research exploring these provider parameters of telemedicine utilization either from Karnataka or anywhere in India. Almost all the studies from India have looked at patient satisfaction and outcomes. Since telemedicine literature points out that physician characteristics and center characteristics (including associated staff characteristics and administrative structures) influenced the telemedicine utilization pattern of a particular center, it was planned to look into these aspects of utilization of telemedicine in this study in the ISRO telemedicine project that is functional in Karnataka. This study aims at exploring individual, professional, organisational, and other situational dimensions that have influenced the utilization of telemedicine technology within the context of this large ISRO-sponsored telemedicine project in Karnataka. The present study focuses on the study of the physician characteristics, barriers to physician acceptance and use and organizational or center characteristics that shape the utilization of telemedicine facilities.

CHAPTER 2 METHODOLOGY

***2.1 Study Type*:** A Descriptive Study

***2.2 Study Setting*:** All the 19 Telemedicine Centers (Government and Private; TSC and TCC) supported by the ISRO-Telemedicine Project in Karnataka. These centers comprised of 13 government health facilities (District Hospitals and Sub-District Hospitals) and 6 specialty centers (corporate/trust/medical college hospitals).

***2.3 Study Period*:** The total time period of the study from the time of data collection to submission of the final report is June 15, 2007 to October 31, 2007. Data collection was accomplished between June 15, 2007 and September 15, 2007.

***2.4 Sample Size*:** All ISRO-supported telemedicine centers in Karnataka State – 19 centers in all (Telemedicine Consulting Centers (TCCs) and Telemedicine Specialty Centers (TSCs); government and private) and all the physicians, administrators and technical support personnel working in the respective centers.

***2.5 Inclusion Criteria*:**

All ISRO-supported telemedicine units in Karnataka State that had been functioning for atleast the past 6 months (as on July 15, 2007) were included (19 in all).

At every center, all physicians available, atleast 1 administrator and atleast 1 technical support person were interviewed. Efforts were made to interview all the physicians who consulted using the telemedicine facility. A total of 45 interviews were conducted at these 19 centers spread across Karnataka.

Table 1: List Of The 19 Centers Studied Along With Their Status And Specialty Field

Sl. No.	TABLE 2.1 - NAME OF THE TELEMEDICINE CENTER	TYPE OF CENTER
1.	Narayana Hrudayalaya, Bangalore	TSC (Cardiology)
2.	JSS Medical College Hospital, Mysore	TSC (Nephrology)
3.	St. John's Medical College Hospital, Bangalore	TSC (Pediatrics)
4.	Samatvam Institute of Diabetology, Bangalore	TSC (Diabetology)
5.	NIMHANS, Bangalore	TSC (Neurology)
6.	Vittala Institute of Ophthalmology, Bangalore	TSC (Ophthalmology)
7.	Taluk Hospital, Maddur, Dist. Mandya	TCC
8.	District Hospital, Karwar, North Kanara	TCC
9.	District Hospital, Navanagar, Bagalkot Dist.	TCC
10.	District Hospital, Chitradurga, Chitradurga Dist.	TCC
11.	Taluk Hospital, Sagar, Dist. Shimoga	TCC
12.	Taluk Hospital, Yadgiri, Gulbarga Dist	TCC
13.	District Hospital, Mandya	TCC
14.	District Hospital, Tumkur	TCC
15.	District Hospital, Chamarajanagar	TCC
16.	District Hospital, Gadag	TCC
17.	District Hospital, Bidar	TCC
18.	Rotary Charitable Hospital, Sirsi, Karwar Dist.	TCC
19.	SVYM Hospital, Saragur, Mysore Dist.	TCC

(Source: Primary Data)

2.6 Data Collection Techniques And Tools:

Primary Data Source:

- Pre-tested structured Interview Schedules
- Each Interview Schedule had 3 parts to it – for the administrator, physician and technical support person.

Secondary Data Sources:

- Facility check-list entered by the investigator using the Tele-Health Log book, Network Utilization Records and Administrative Records,
- ISRO project documents, implementation phase documents, TSP and vendor project documents, training modules, other relevant literature, brochures and handbook of telemedicine published by ISRO, etc.

The Interview Schedules were administered to the physicians, administrators and technical support personnel individually in the telemedicine facility itself ensuring complete privacy. All interviews at a particular center were conducted on the same day of the visit to the center. The Facility checklist was entered for each center by crosschecking the available log book records, administrative records and network utilization records on the same day of the visit to the center. At a few centers, since all the staff were not available on the same day, the researcher halted at that place and visited the center again the next day.

2.7 ***Data Analysis*****:** Data obtained was entered into Microsoft Excel 2007 and then imported to SPSS 15.0 for statistical analysis.

2.8 ***Operational Definition Used for Measuring Utilization of Telemedicine***:
Utilization = Total number of Tele-consultations + Total number of Tele-diagnosis consultations + Number of CME's attended/engaged in the reference month of July 2007.

2. 9 ***Ethical Considerations***:

- Permission was obtained from the Institutional Ethics Committee of SCTIMST before commencement of the study.
- Written informed consent was obtained from all participants before conducting the interviews.
- Confidentiality was maintained throughout and all information provided by the participants is under the safe custody of the researcher. All information that identifies personnel has been delinked.
- Data collected from the interviews and facility checklist is being used solely for the purpose of this research.
- Official written permission from the Karnataka State Health Department and Indian Space Research Organization (ISRO) had been obtained prior to conducting the study.

2.10 Variables

All independent variables were identified from indexed international literature that looked into factors affecting telemedicine utilization (the outcome variable) and the variables selected for **physician characteristics** include: physician awareness, training, acceptance, willingness, patient needs, satisfaction with TM consultations, need for incentives, relationship with specialist/consulting physicians, and the perceived need for telemedicine. Among **center characteristics**, the 'administrator' variables include: administrator willingness to use telemedicine; staffing; training of staff; costs, funding and self-sustenance; safety, security and confidentiality of PIR. The 'technician' variables include: the telemedicine room; telemedicine devices and diagnostic equipment; connectivity; quality of images and speed of transmission; and service and maintenance.

2.11 Plan For Dissemination:

Apart from fulfilling the dissertation requirements of the MPH course at AMCHSS, it is being visualized to put forth the findings of this study through a publication for the sake of knowledge advancement in this field. The study findings would be shared with ISRO (Bangalore Headquarters) and the Karnataka State Health Services. Both would be apprized of the findings regarding factors influencing the utilization of telemedicine in the ISRO Karnataka TM project. Appropriate recommendations will be made based on the findings to improve utilization of telemedicine by ensuring effective participation of the physicians, the main users of the technology, along with the positive involvement of the center staff (technical and administrative staff) towards better utilization of the project facilities. This study would enable ISRO to become aware of what influences utilization, take necessary action and improve project performance by facilitating physicians and centers to optimally utilize telemedicine facilities. These findings and recommendations would help ISRO improvise its focus and strategy for other states in India where similar telemedicine projects have been initiated and similar ground realities exist.

CHAPTER 3 RESULTS

3.1 SAMPLE CHARACTERISTICS

Keeping in mind the main objective - to study the telemedicine utilization by physicians under the ISRO Telemedicine Project in Karnataka and the specific objectives - to explore the linkages between 'physician' characteristics and utilization of telemedicine and the linkages between 'telemedicine center' characteristics and utilization of telemedicine, the variables that emanated from the rich literature on telemedicine utilization were identified and included in the study and the following is the summary of the results. Sample characteristics of the TM centers are presented in detail below.

3.1.1 NAME OF CENTER, TYPE, YEAR OF STARTUP AND NUMBER OF TELE-CONSULTATIONS IN THE REFERENCE MONTH OF JULY 2007

TABLE 3.1: CENTER TYPE, YEAR OF STARTUP, NUMBER OF TELECONSULTATIONS IN REFERENCE MONTH

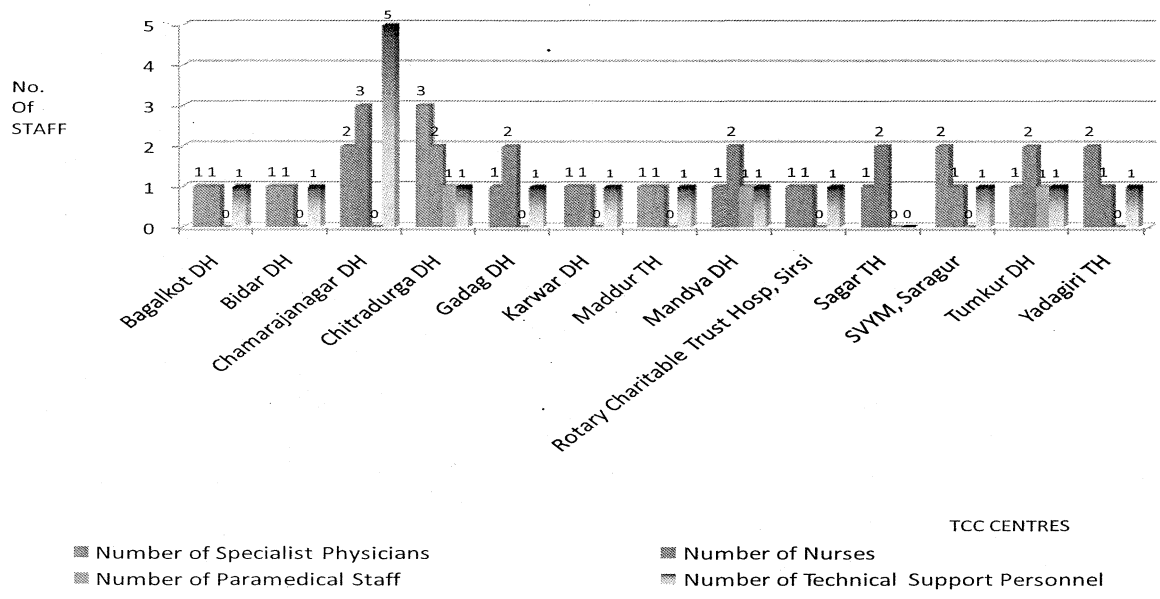
Name of the Telemedicine Center	Designation of the Telemedicine Center	Type of Telemedicine Center	TM center established in the year	Number of Telemedicine Consultations in July 2007
Bagalkot DH	District Hospital	TCC	2004	6
Bidar DH	District Hospital	TCC	2003	50
Chamarajanagar DH	District Hospital	TCC	2002	97
Chitradurga DH	District Hospital	TCC	2004	25
Gadag DH	District Hospital	TCC	2004	90
JSS Medical College Hospital, Mysore	Medical College Hospital	TSC	2004	18
Karwar DH	District Hospital	TCC	2003	11
Maddur TH	Sub-divisional Hospital	TCC	2004	15
Mandya DH	District Hospital	TCC	2005	0
Narayana Hrudayalaya	Corporate Hospital	TSC	2002	176
NIMHANS	Govt. Specialty Hospital	TSC	2004	0
Rotary Charitable Trust Hosp, Sirsi	NGO Hospital	TCC	2003	0
Sagar TH	Sub-divisional Hospital	TCC	2004	39
Samatvam Inst. of Diabetology	NGO Hospital	TSC	2004	0
St. John's Medical College	Medical College Hospital	TSC	2004	0
SVYM, Saragur	NGO Hospital	TCC	2004	7
Tumkur DH	District Hospital	TCC	2004	23
Vittala Institute of Opthalmology	NGO Hospital	TSC	2004	143
Yadagiri TH	Sub-divisional Hospital	TCC	2004	6

(Source: Secondary data, facility checklist)

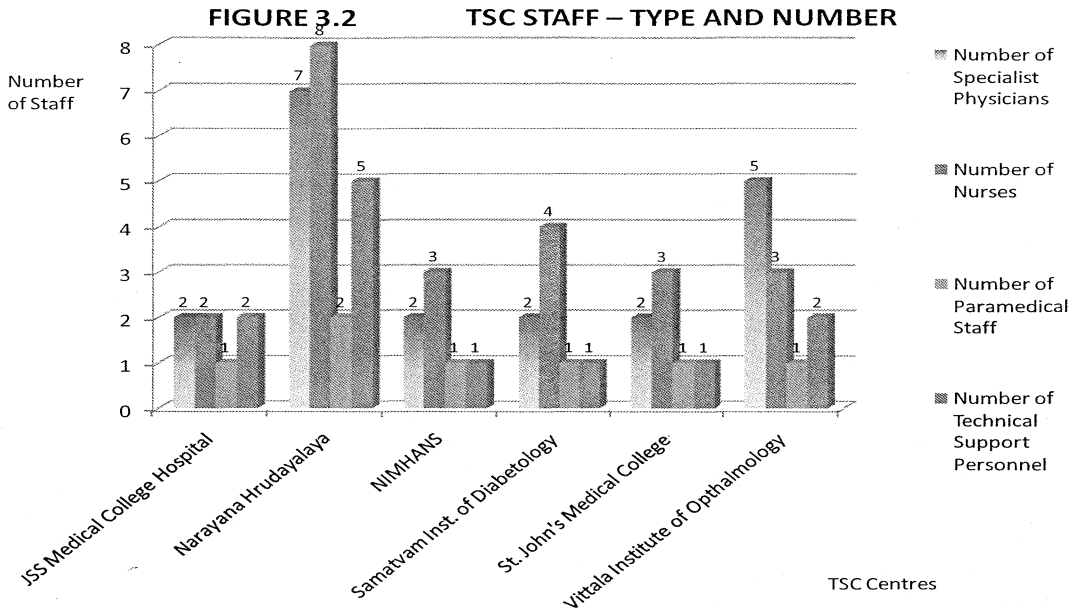
Of the total 19 centers, 13 were Telemedicine Consulting Centers (TCCs) and 6 were Telemedicine Specialty Centers (TSCs). The project which began with 2 centers, namely Narayana Hrudayalaya as the first specialty partner and Chamarajanagar District Hospital (DH) as the first consulting partner in 2002 now boasts of a network of 19 centers as of July 2007. A majority of these centers, however, became fully operational in 2004. The type of connectivity link in these Telemedicine centers is mainly VSAT with only 2 centers depending on ISDN lines.

3.1.2 TYPE AND NUMBER OF STAFF AT TCCs AND TSCs

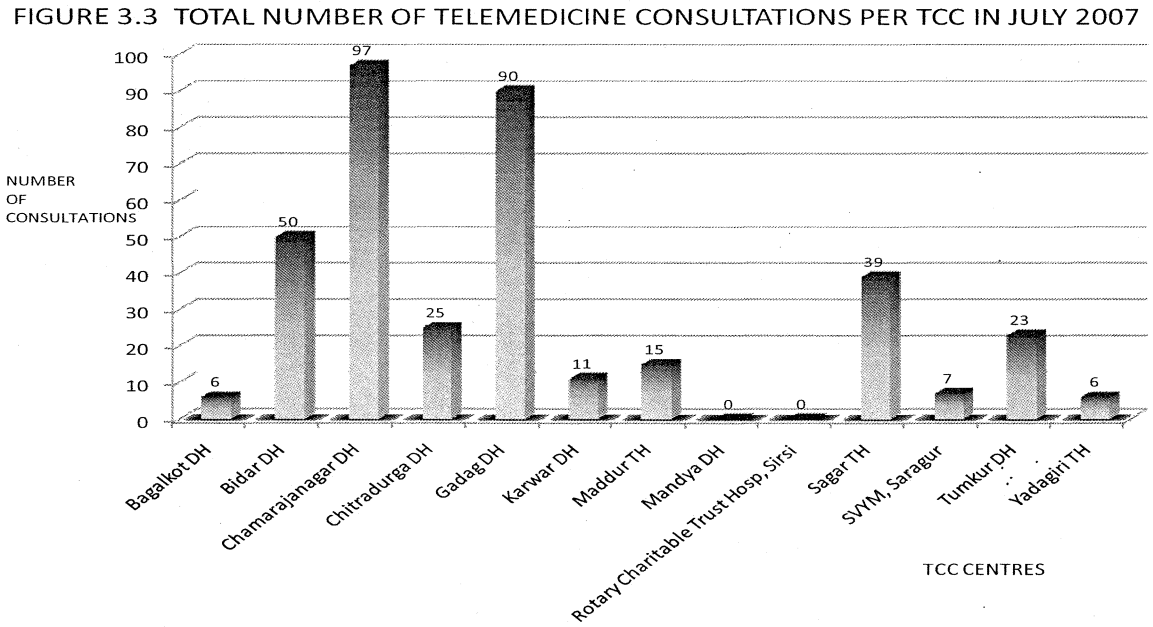
FIGURE 3.1 TCC STAFF – TYPE AND NUMBER



As seen in Figure 3.1, Chamarajanagar DH had the highest number of nurses and technical support personnel in the TM center while Chitradurga DH has the maximum number of physicians available for attending to telemedicine consultations. As seen in Figure 3.2, among the TSCs, Narayana Hrudayalaya and Vittala Institute of Ophthalmology had substantially higher numbers of specialist physicians, nurses and technical support personnel compared to other TSCs.

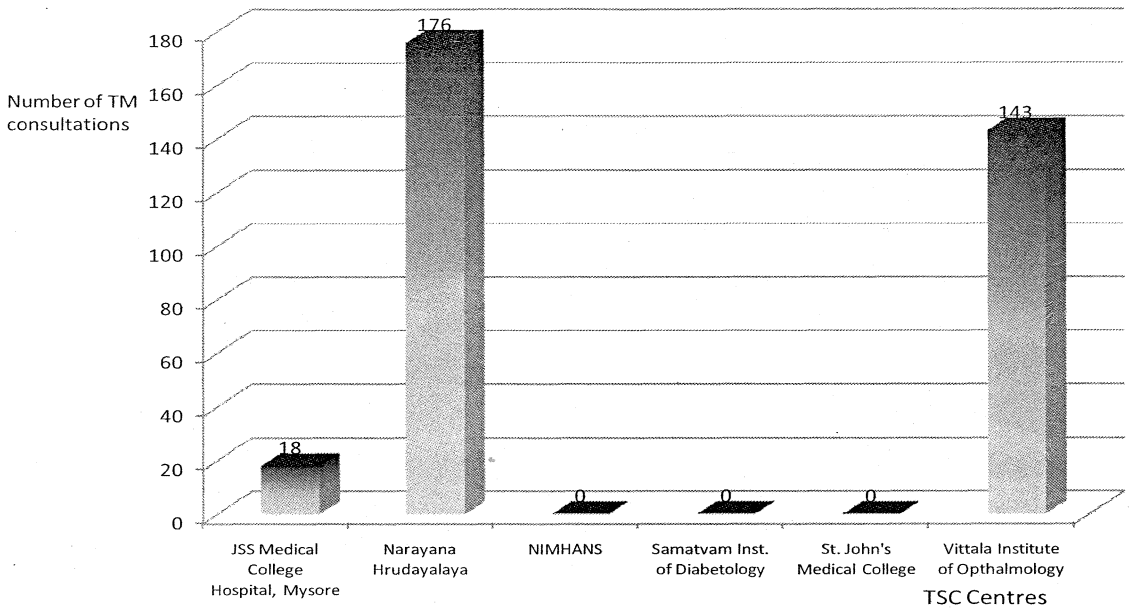


3.1.3 NUMBER OF TELEMEDICINE CONSULTATIONS PER MONTH



As depicted in Figure 3.3, few TCCs such as Chamarajanagar DH (with 97) and Gadag DH (with 90) followed by Bidar DH (with 50) had recorded far higher number of telemedicine consultations compared to the other TCCs.

FIGURE 3.4 TOTAL NUMBER OF TELEMEDICINE CONSULTATIONS PER TSC IN JULY 2007

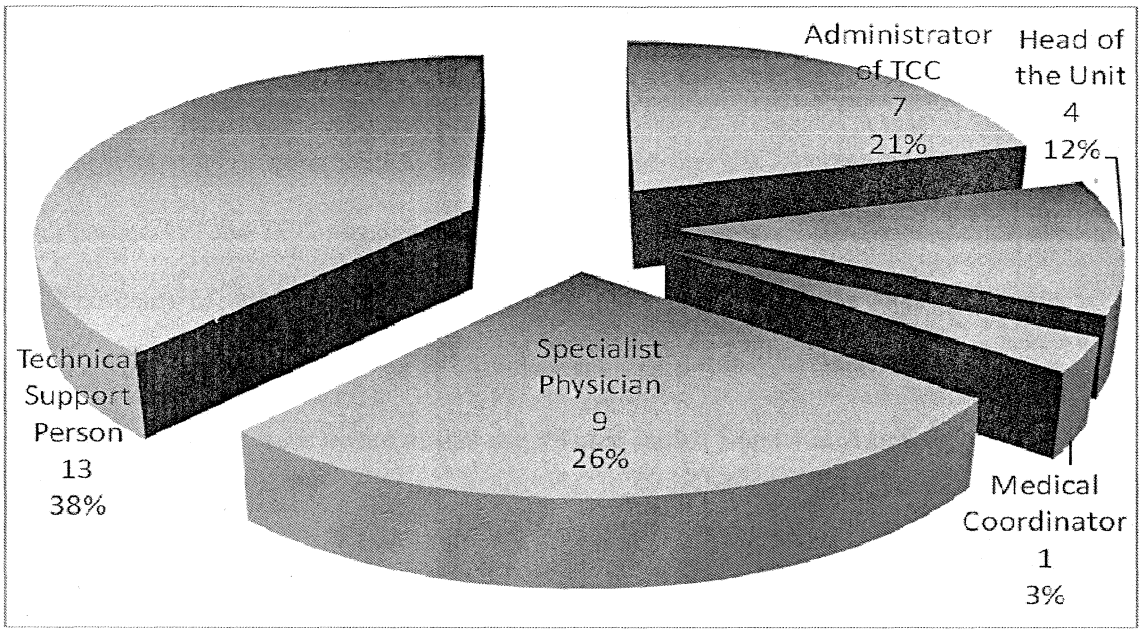


As can be observed from Figure 3.4, only 2 (Narayana Hrudayalaya with 176 consultations and Vittala Institute of Ophthalmology with 143) out of the 6 TSCs stand apart with substantial number of consultations recorded when compared to the rest. Three of the TSCs had not begun consulting due to unresolved connectivity issues and shortage of manpower.

3.1.4 TYPE OF STAFF, AGE AND SEX PROFILE OF THE STAFF

Among the TCCs studied, the respondents included 7 (20.6 percent) administrators with a mean age of 51 years, 14 (41.2 percent) physicians with a mean age of 44 years and 13 technicians (38.2 percent) with a mean age of 39 years. Among these, 29 (85.3 percent) were males with a mean age of 46 years and 5 (14.7 percent) were females with a mean age of 31 years. Among the TSCs studied, the respondents included 4 (37 percent) administrators with a mean age of 43 years, 3 (27 percent) specialist physicians with a mean age of 50 years, 4 (36 percent) technicians with a mean age of 30 years. All of them were males with a mean age of 40 years. The total number of respondents was 45. (Refer Table 1 in Annexure)

3.1.5 STAFF PROFILE OF THE CENTERS - BY DESIGNATION



3.1.6 HIGHEST EDUCATIONAL QUALIFICATION OF THE STAFF

In terms of the highest educational qualification among the TSC staff, 9 percent were DM qualified, 37 percent of them were MS degree holders, 9 percent were MD's, 18 percent were MHA degree holders and BSc graduates constituted 27 percent. Among TCC staff, 23 percent were MD's, 17 percent were PG diploma holders, 12 percent were MBBS qualified, 3 percent were MS degree holders, another 3 percent were MBA's, 9 percent were BSc graduates, 15 percent had done a certificate course, and 18 percent held 'any other diploma'. The MHA holders were administrators while BSc and diploma holders were technical support personnel. (Refer Chart 1 and 2 in Annexure).

3.2 PHYSICIAN CHARACTERISTICS

3.2.1 PHYSICIAN AWARENESS REGARDING THE USES OF TELEMEDICINE

Beginning with awareness regarding the uses of telemedicine, all the 14 (100 percent) physicians interviewed in the TCC and all the 3 physicians from the TSC were familiar with

telediagnosis consultations. Only 11 (78.6 percent) of the TCC physicians were familiar with clinical tele-consultations whereas all 3 (100 percent) specialist physicians at the TSC were familiar with it. Only 4 (28.6 percent) of the TCC physicians were familiar with CMEs through telemedicine compared to 3 (100 percent) of the TSC specialist physicians. Only 2 (14.3 percent) of the TCC physicians were aware of e-governance meetings as compared to 2 (66.7 percent) of the TSC physicians. Only 2 (14.3 percent) of the TCC physicians were aware of the use of telemedicine in disasters such as relief work while 33.3 percent of the specialist physicians were aware of this use. (Refer Tables 3 and 4 in Annexure)

Among TCC physicians, 64.3 percent felt the main use of telemedicine was to provide specialist consultation to patients who are away from the center while 35.7 percent of them reported that it was to connect physicians and facilitate CME and professional discussions. In the TSC, however, all the physicians felt the main was to provide specialist consultation to patients who are away from the center. About 93 percent of TCC physicians and all the TSC physicians accepted that telemedicine had benefitted them. While 57.1 percent of TCC physicians did not mention any benefit of telemedicine to a physician, the remaining 43 percent of physicians cited benefits such as - 'difficult cases can be diagnosed and treated' using telemedicine, 'easy diagnosis and treatment' was possible, 'expert opinion' was possible, and 'second opinion for complicated cases and to improve knowledge'. Among the TSC physicians; responses varied from – 'as an eye surgeon, I can treat remote patients', 'can treat many patients at once and hence save time', 'patients in remote areas can save time and money', etc.

Regarding time saved to the physician, among TSC physicians, 66.7 percent of them felt telemedicine saved time for them compared to 50 percent of TCC physicians. About 36 percent of the TCC physicians and one-third of TSC physicians were not sure if it saved time

and 14.3 percent of them reported that it did not save time. However, 85.7 percent of TCC physicians did not answer to how it saved time but one physician reported that by being 'able to diagnose and treat patients from remote areas' it saves time. Another reported that by 'providing the opinion of cardiologists and other super-specialists in a short span of time' it saves time. Opinions in TSC ranged from –'follow-up can be done easily' hence saves time, 'many patients can be consulted in a given slot' to 'prompt and quick consultation, periodic monitoring' saves time. About 70 percent of TCC physicians and all the TSC physicians reported telemedicine saved travel costs to physicians. All TCC and TSC physicians reported that telemedicine was useful to the patient. About 36 percent of TCC physicians reported that telemedicine 'saves time and travel costs' followed by 21.4 percent who reported that it provides 'early diagnosis and treatment for patients'.

One-third of TSC physicians responded that telemedicine is useful to the patient as it is 'prompt and economical', another one-third felt it 'provides expert consultation' and another one-third of them felt its useful as 'a specialist sees the patients'. About 15 percent of TCC physicians felt that telemedicine 'avoids the need for appointments' while another 15 percent felt it 'saves travel time to a higher center'. All the TSC physicians reported that telemedicine saves time because 'there is immediate consultation', 'no need to travel' and 'no waiting queues'. When asked how telemedicine saved time, about 21 percent of TCC physicians said that telemedicine saves travel costs to the patient as it 'avoids travel to the tertiary care center' while one-third of TSC physicians reported that there was 'no need to travel' with telemedicine. The importance of physician awareness of telemedicine on the utilization of telemedicine is noted here.

3.2.2 *PHYSICIAN'S TRAINING IN TELEMEDICINE*

FIGURE 3.7 LEVEL OF TRAINING

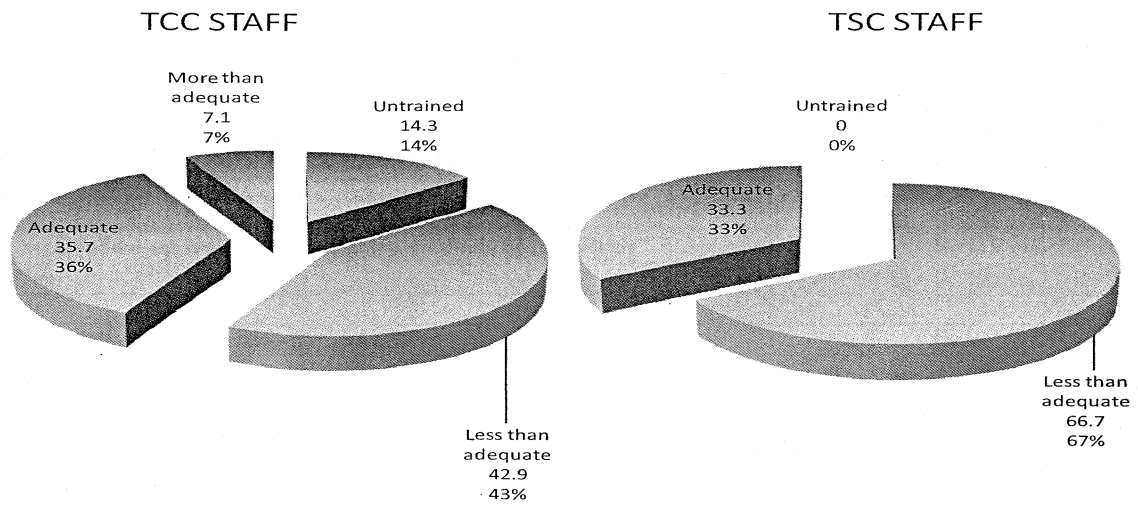
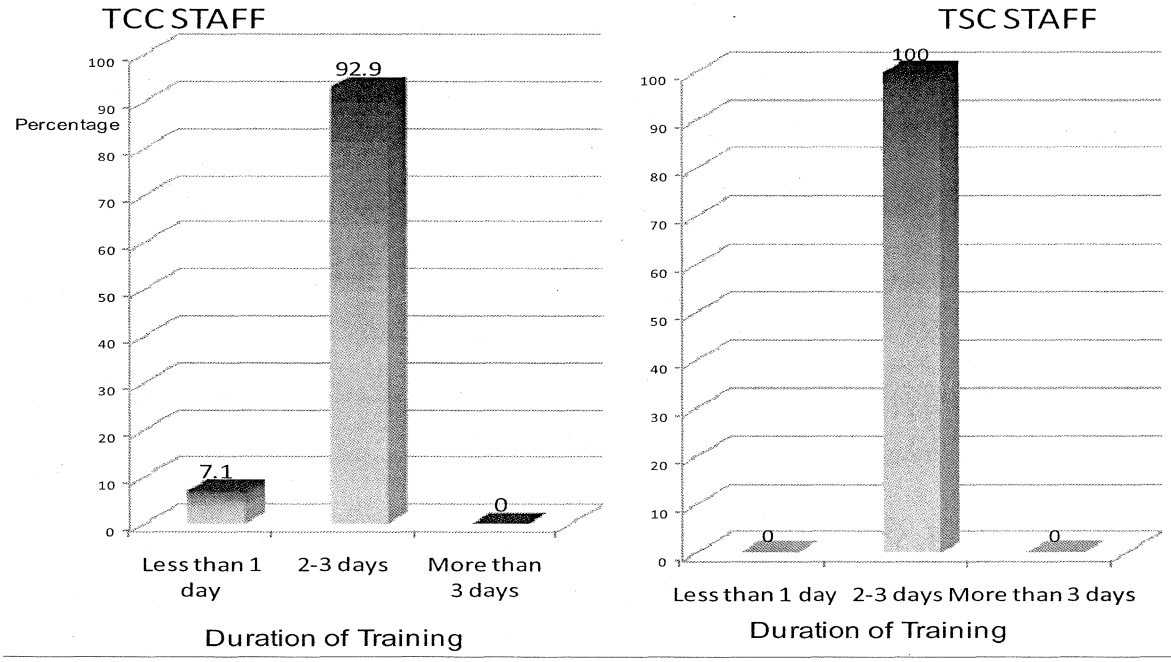


FIGURE 3.8 DURATION OF TRAINING UNDERGONE



Among the TCC physicians, nearly 72 percent of them had been trained by the telemedicine service provider (TSP) after installation of the equipment whereas all TSC physicians were trained by the TSP. Around 57 percent of TCC physicians and one-third of TSC physicians reported that the training lacked in some aspects. 1 TCC physician had obtained additional

training from a different source. As high as 86 percent of TCC physicians and two-thirds of TSC physicians reported that they needed further follow-up training in telemedicine usage.

TABLE 3.2 – NEED FOR TRAINING IN TCC AND TSC PHYSICIANS		
Need follow-up training on recent advances in the process	**TCC**	**TSC**
Yes	10 (71.4%)	2 (66.7%)
No	4 (28.6%)	1 (33.3%)
Need follow-up training to adapt to newer technologies		
Yes	10 (71.4%)	2 (66.7%)
No	4 (28.6%_	1 (33.3%)
Need follow-up training on effective methods of consulting		
Yes	10 (71.4%)	2 (66.7%)
No	4 (28.6%)	1 (33.3%)
Need follow-up training on standards of care guidelines		
Yes	9 (64.3%)	3 (100%)
No	5 (35.7%)	0 (.0%)

(Source: Primary Data)

Only 21.4 percent of TCC physicians felt that their 'fellow physician, nurses and paramedical staff were adequately trained in telemedicine as compared to two-thirds of the physicians at the TSC. (Refer Tables 9 and 10 in Annexure). The importance of training is thus evident here.

3.2.3 PHYSICIAN ACCEPTANCE OF TELEMEDICINE AS AN USEFUL AND EASY TO USE TOOL

TABLE 3.3 - USEFULNESS AND COMFORT LEVEL OF PHYSICIANS		
CHARACTERISTIC	**TCC**	**TSC**
Usefulness		
Somewhat useful	9 (64.3%)	0 (.0%)
Very useful	5 (35.7%)	3 (100%)
Comfort		
Somewhat comfortable	10 (71.4%)	1 (33.3%)
Very comfortable	4 (28.6%)	2 (66.7%)

(Source: Primary Data)

Nearly 79 percent of TCC physicians and all the TSC physicians (100 percent) felt that telemedicine consultations were more feasible that having a patient sent to the specialty center in person. About 71 percent of TCC physicians and all the TSC physicians (100 percent) reported that that telemedicine consultation is feasible because patient's travel cost is saved. Only 28.6 percent of TCC physicians reported that telemedicine consultations were feasible because they saved physician's time whereas all the TSC physicians felt it saved time for the physician. Regarding the frequency of engaging in telemedicine consultations, 57.1

percent of TCC physicians reported '1-2 times a month' and 28.6 percent reported '1-2 times a week' whereas 66.7 percent of TSC physicians reported '1-2 times a month'. (Refer Tables 5 and 6 in Annexure). Regarding the usefulness to patients, 64.3 percent of TCC physicians reported that telemedicine was 'somewhat useful' to patients and 35.7 percent of them reported that it was 'very useful' whereas all TSC physicians (100 percent) reported that it was 'very useful' to patients. Regarding the ease of use, 78.6 percent of TCC physicians and all TSC physicians reported that tele-diagnosis consultations were easy to participate in. Around 86 percent of TCC physicians and all TSC physicians reported that tele-consultations were 'easy to engage' in. About 21 percent of TCC physicians and two-thirds percent of TSC physicians reported that continuing medical education (CME) sessions were easy to engage in. Only 21.4 percent of TCC physicians and two-thirds of TSC physicians reported that e-governance meetings were easy to engage in.

3.2.4 PHYSICIAN WILLINGNESS TO USE TELEMEDICINE

In terms of frequency of consultation with TSC physicians, only 7.1 percent of TCC physicians consulted 'every single time' with TSC physicians, 57.1 percent of the TCC physicians consulted 'sometimes' with TSC physicians, and 35.7 percent 'rarely' consulted with TSC physicians. Two-thirds of TSC physicians 'often attended' to requests for telemedicine consultation from TCCs. With regard to making time for tele-consultations when seeing patients in the clinic, 42.9 percent of TCC physicians prepared a schedule in advance and worked accordingly, 28.6 percent of TCC physicians keep aside time for tele-consultations and 28.6 percent arranged a backup physician to handle patients in person. Among TSC physicians, one-third of them keep aside time for tele-consultations whereas two-thirds of them arranged a backup physician to handle patients in person. About organizing CME sessions from their TCC, nearly 86 percent of TCC physicians had 'never' organized a CME, 7.1 percent of them said they had organized CME's 'rarely' and 7.1

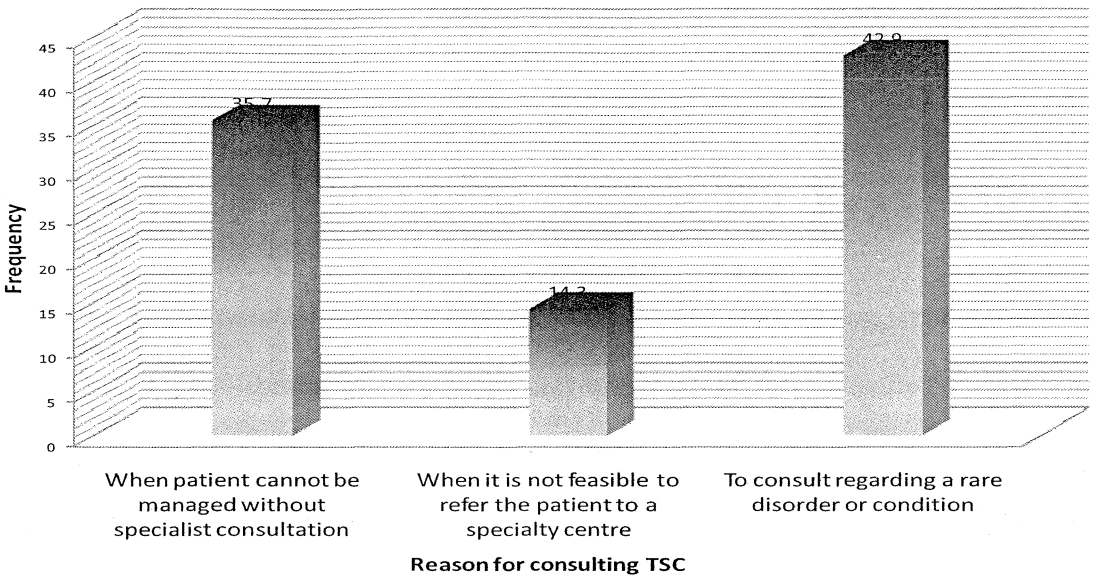
percent of them had organized 'often'. Among TSCs physicians, one-third of them had organized CME sessions through telemedicine and one-third of them organized CME's 1-2 times/week. With respect to requesting a TSC to conduct a CME on a topic of interest, half of the TCC physicians had 'never' requested, 14.3 percent of them had requested 'rarely' and 7.1 percent of them had requested 'often'. All the TSC physicians had attended to 'most of the' CME's telecasted from other specialty centers. Two-thirds of the TSC physicians were utilizing other applications of telemedicine such as mobile telemedicine units. (Refer Tables 7 and 8 from Annexure)

3.2.5 PATIENT NEEDS FELT BY THE PHYSICIAN

With regards to consulting for patient needs, 7.1 percent of the TCC physicians consulted TSCs 'very often' for patient needs, 35.7 percent of them consulted 'often', another 35.7 percent of them consulted 'sometimes' and 21.4 percent of them consulted 'rarely'. Only 14.3 percent of the TCC physicians reported that patients had requested them to consult with specialist physicians in the last month. Also, around 93 percent of the TCC physicians reported that 'no patient' refused to participate in a teleconsultation with a specialist physician. (Refer Table 11 in Annexure)

Nearly 43 percent of the TCC physicians reported that 'physicians' informed the patient regarding the TM consultation and procedure, nearly 36 percent said that 'nurses' were informing, 14.3 percent of them reported that the 'technical support person' was informing while 7.1 percent reported that the 'administrator' was informing. All the TCC physicians obtained patient willingness 'orally'.

FIGURE 3.9 TCC physician - most common reason for consulting a TSC



3.2.6 PHYSICIAN SATISFACTION WITH TELEMEDICINE CONSULTATIONS

In terms of satisfaction with the quality of consultation that is possible through telemedicine, nearly 71 percent of TCC physicians reported that the quality was 'average' and nearly 29 percent reported that the quality was 'good'. Among TSC physicians, two-thirds of them reported that the quality was 'average' while one-third of them reported that the quality was 'good'. Among the TCC physicians, around 43 percent of them reported that the patient did not stand to gain from a tele-consultation with the TSC specialist team while around 57 percent reported that the patient gained from such a consultation. On the other hand, all the TSC physicians reported that a patient from the TCC stood to gain from a tele-consultation with the TSC physicians. On whether the TSC physicians were able to diagnose conditions accurately through tele-consultation of diagnostic values and physical examination done at the TCC, 21.4 percent of TCC physicians reported 'yes, very accurately' compared to 71.4 percent who reported 'yes, substantially'. Among the TSC physicians, all of them reported

that they could diagnose the condition 'substantially' through telemedicine. (Refer Tables 12 and 13 in Annexure)

Among the TCC physicians, around 43 percent of them had not attended any CME. Among the 57 percent physicians who attended CMEs, around 36 percent had found CME's to be 'quite satisfying' while around 21 percent reported that it was 'satisfying'. On the other hand, all the TSC physicians had attended and conducted CMEs. Among them, two-thirds reported that it was 'somewhat satisfying' and one-third of them reported that it was 'satisfying'. Nearly 36 percent of TCC physicians had not used telemedicine for engaging in research or other collaborations with other institutes. Out of the other 64 percent who had used it for research, around 43 percent were 'somewhat satisfied' with the consultation and nearly 21 percent of them found it 'satisfying'. Among the TSC physicians, nearly two-thirds of them reported that it was 'somewhat satisfying' while one-third of them felt it was 'satisfying'. With regards to e-governance through telemedicine, half of the TCC physicians reported of 'not having used it'. From the half of them that used it, around 36 percent reported of having used it and being 'somewhat satisfied' with the process while another 14 percent reported that it was 'satisfying'. Among TSC physicians, all of them had used it and nearly two-thirds reported that it was 'somewhat satisfying' while one-third of them felt it was 'satisfying'. On the use of telemedicine for disaster management consultations, 64.3 percent of TCC physicians 'had not used' it, 28.6 percent found it 'somewhat satisfying' and 7.1 percent reported being 'satisfied' with the consultation. The importance of satisfaction in telemedicine utilization can be noted here.

3.2.7 PHYSICIAN NEED FOR INCENTIVES TO USE TELEMEDICINE

Exploring the need for incentives, around 64 percent of TCC physicians felt incentives were needed to encourage use of telemedicine while around 36 percent felt incentives were not

needed. However, all of the TSC physicians reported that incentives were necessary to use telemedicine to a greater extent. None of the TSC physicians were obtaining incentives to use telemedicine. Only 7.1 percent of the TCC staff reported having 'incentives' to engage in telemedicine. On whether an incentive structure would make them engage in telemedicine consultations more regularly, 64.3 percent of them agreed. All the TSC physicians felt that that an incentive structure would enable them to use telemedicine more frequently, however, none of them reported that that underutilization was due to the absence of an incentive structure. (Refer Tables 14 and 15 in Annexure)

3.2.8 PHYSICIAN RELATIONSHIP WITH CONSULTING PHYSICIANS AND OTHER SPECIALIST PHYSICIANS

Among the TCC physicians, around 57 percent had TSC physicians who were personal acquaintances while all the TSC physicians reported that the TCC physicians they engaged with were their personal acquaintances. On whether familiarity with TSC physicians increased their frequency of consulting with them, 21.4 percent of TCC physicians reported 'no difference', 57.1 percent reported of consulting 'somewhat frequently' and 21.4 percent reported consulting 'frequently'. Among TSC physicians, two-thirds of them reportedly consulted 'somewhat frequently' with personal acquaintances while one-third of them consulted 'more frequently' than usual. Nearly 79 percent of TCC physicians and all the TSC physicians reported that 'familiarity with the TSC physician' contributed to a smoother telemedicine consultation to a large extent. Around 93 percent of TCC physicians and all the TSC physicians reported that that 'telemedicine helps build new acquaintances and professional friendships across different centers'. (Refer Tables 16 and 17 in Annexure)

3.2.9 PHYSICIANS' PERCEIVED NEED FOR TELEMEDICINE

It was found that 21.4 percent of TCC physicians and one-third of the TSC physicians attended professional gatherings/CME's/interactive seminars/conferences 'quite often'.

Around 36 percent of TCC physicians reported that distance from the venue of the event prevented them from attending professional gatherings/CME's/interactive seminars/conferences. Around 21 percent of TCC physicians and one-third of TSC physicians reported that that travel requirements prevented them from attending. Only 7.1 percent of TCC physicians reported that the cost of attendance prevented them from attending professional gatherings/CME's/interactive seminars/conferences. For around 43 percent of TCC physicians, 'workload' prevented them from attending professional gatherings/CME's/interactive seminars/conferences while one-third of TSC physicians reported that 'time constraints' prevented them from attending professional gatherings/CME's/interactive seminars/conferences. Around 43 percent of TCC physicians and one-third of TSC physicians reported that telemedicine-through professional gatherings/CME's/interactive seminars/conferences can replace the need to travel and attend these events. Around 79 percent of TCC physicians and all the TSC physicians reported that the use of telemedicine is less and more can be done using telemedicine. However, 21.4 percent of TCC physicians reported that the 'use of telemedicine is high but the usefulness is debatable'. (Refer Tables 18 and 19 in Annexure)

3.3 CENTER CHARACTERISTICS

3.3.1 ADMINISTRATOR CHARACTERISTICS

3.3.1.1 WILLINGNESS TO USE TELEMEDICINE

In exploring the willingness of administrators, around 71 percent of TCC administrators reported that their center engaged in telemedicine consultations 1 to 2 times a week while 75 percent of TSC administrators reported that their center engaged in TM consultations everyday. Among the most common type of consultations engaged in by TCCs, around 57 percent of administrators reported of tele-diagnosis consultations with TSCs followed by

around 43 percent who engaged in tele-consultations with TSCs. (Refer Tables 20 and 21 in Annexure). Among TSC administrators, half of them reported of engaging in either type of consultation. Nearly 86 percent of TCC administrators and three-fourths of TSC administrators 'maintained a log book' to inform personnel regarding consultation schedules and appointments. Only 14.3 percent of TCC administrators and all the TSCs administrators conveyed 'orally' to personnel regarding consultation schedules and appointments. Around 86 percent of TCC administrators and half of TSC administrators 'encouraged personnel to use telemedicine facilities', 14.3 percent of TCC administrators and half of TSC administrators 'monitored use and recommended at times'. 14.3 percent of TCC administrators gave physicians' time to attend to telemedicine, 14.3 percent used 'repeated pursuing' to encourage use and another 14.3 percent 'sent doctors on rotation to the telemedicine room' to encourage use. 25 percent of TSC administrators offered incentives and recognition to encourage usage. According to 57.1 percent of TCC administrators, the best way to encourage use was to 'motivate' staff while three-fourths of TSC administrators reported that 'repeated re-enforcing' was the best way to encourage use.

3.3.1.2. STAFFING AT TCCs AND TSCs

Table 3.4 – STAFFING PATTERNS AT TSC

Telemedicine Specialty Center (TSC)	Number of Specialist Physicians	Number of Nurses	Number of Paramedical Staff	Number of Technical Support Personnel
JSS Medical College Hospital	2	2	1	2
Narayana Hrudayalaya	7	8	2	5
NIMHANS	2	3	1	1
Samatvam Inst. of Diabetology	2	4	1	1
St. John's Medical College	2	3	1	1
Vittala Institute of Opthalmology	5	3	1	2

(Source: Primary Data)

In terms of staffing, 57.1 percent of the TCC administrators 'maintained the same staff strength throughout the year' as did three-fourths of the TSC administrators. Around 71 percent of the TCC administrators and all TSC administrators had difficulty in obtaining

trained staff. Nearly 43 percent of TCC administrators and half of TSC administrators had difficulty in retaining trained staff. Around 86 percent of TCC administrators and one-fourth of TSC administrators were unable to recruit more staff due to financial restrictions. Nearly 43 percent of TCC administrators reported of absenteeism of workers. Around 86 percent of the TCC administrators and one-fourth of TSC administrators reported of unfilled staff positions. (Refer Tables 22 and 23 in Annexure). At the TCC administrators end, reasons for non-regular utilization of telemedicine were: 'non-scheduling of consultations' reported by 43 percent, 'lack of time' reported by 43 percent, 'busy with other responsibilities' by 57 percent, 'lack of initiative among staff' by 29 percent and 'lack of financial incentives' by 29 percent. TSC administrators' minimized non-utilization of telemedicine facilities by providing career-growth incentives (one-fourth), handled staff problems immediately (one-fourth), payroll incentives (one-fourth) and retrained staff (one-fourth).

3.3.1.3 TRAINING OF STAFF

Among the TCC administrators, nearly 43 percent reported that 'none of their staff' had received post-implementation training from the Telemedicine Service Provider (TSP) whereas only one-fourth of TSC administrators reported that 'all of their staff' had received post-implementation training. Among the TCC staff, nurses had availed the maximum amount of training reported at around 57 percent, followed by technical support personnel at 29 percent. Among the TSC staff, half of the administrators reported that technical support personnel had availed the maximum amount of training. None of the TCCs had carried out dry runs using test or non-patient data before starting consultations whereas half of the TSCs had carried out such dry runs. Every one of the TCC administrators reported that their staff needed further 'follow-up training in telemedicine consultations' whereas three-fourths of TSC administrators reported the same. Around 57 percent of the TCC administrators reported that their center had organized follow-up training for their staff 'once in 6 months' and the

rest had organized 'once in a year'. Half of the TSC administrators had organized further 'follow-up training in telemedicine consultations' once in 6 months for their staff whiles the other half had 'never' organized trainings for their staff. Nearly 29 percent of TCC administrators 'scheduled follow-up training for staff' whereas around 71 percent of them 'ensured that trained staff were retained' for efficient functioning. On the other hand, one-fourth of TSC administrators 'recruited trained staff', half of them 'scheduled follow-up training for staff' while one-fourth of them 'encouraged staff to undergo training elsewhere'. (Refer Tables 24 and 25 in Annexure).

3.3.1.4 COSTS, FUNDING AND SELF-SUSTENANCE

In terms of self-sufficiency of the TM center, only 14.3 percent of TCC administrators reported that their center was 'financially self-sufficient' to cover operational costs of telemedicine. On the other hand, three-fourths of TSC administrators reported that their center was 'financially self-sufficient'. Around 71 percent of TCC administrators reported that their center had the maximum proportion of their telemedicine expenditure covered by the 'government' whereas only one-fourth of TSC administrators reported that their center's expenditure was covered by the 'government'. Three-fourths of the TSC administrators reported that 'parent institution funding' took care of their telemedicine expenditure. (Refer Tables 26 and 27 in Annexure). Around 43 percent of TCC administrators reported that they were not facing any problem managing the costs of telemedicine usage whereas another 43 percent of them reported they had a 'slight inconvenience'. On the other hand, only one-fourth of TSC administrators reported that they 'found it difficult to manage the costs of telemedicine usage'. Regarding plans for sustaining the TCC if government/other agency assistance is withdrawn, nearly 86 percent of TCC administrators opined that they would 'institute user charges' and 14.3 percent reported of 'seeking external support'. Three-fourths

of TSC administrators reported of seeking 'own institute funding' while one-fourth of them opined to 'instituting user charges' if governmental assistance is withdrawn.

3.3.1.5 SAFETY, SECURITY AND CONFIDENTIALITY OF PATIENT RECORDS

In around 71 percent of the TCC centers, the patient information record (PIR) database was being maintained by the 'technical support personnel' and in 14.3 percent of the centers by the 'administrator'. In all the TSC centers, the PIR database was being maintained by the 'technical support personnel'. (Refer Tables 28 and 29 in Annexure). There had been no case of breach of safety, security and confidentiality at any of the TCC or TSC centers thus far. Around 71 percent of the TCC administrators and all the TSC administrators reported that they followed 'guidelines for maintaining safety, security and confidentiality of patient records'. However, around 86 percent of the TCC administrators and three-fourths of the TSC administrators did not know which guidelines they were following. Around 43 percent of the TCC administrators and half of the TSC administrators reported that the 'PIR databases were password protected'. Around 57 percent of TCC administrators and half of TSC administrators reported that a 'designated person monitors this aspect routinely'. Around 57 percent of TCC administrators and all the TSC administrators were uploading patient records to other referral centres where the patient might be referred.

3.3.2 TECHNICIAN CHARACTERISTICS

3.3.2.1 TELEMEDICINE ROOM

Regarding characteristics of the Telemedicine Room, nearly 85 percent of the TCC technicians and all TSC technicians had a designated telemedicine room for consultations. Around 31 percent of TCC technicians and half of TSC technicians reported of having a telemedicine consultation room of the size 12' x 20'. Around 31 percent of TCC technicians

and one-fourth of TSC technicians reported of having a telemedicine consultation room of the size 15' x 30'. Around 39 percent of TCC technicians and one-fourth of TSC technicians reported of having a telemedicine room of a different size. (Refer Tables 30 and 31 in Annexure)

TABLE 3.5 - TELEMEDICINE ROOM – TYPES OF CONSULTATIONS POSSIBLE		
TYPE OF CONSULTATION	**POSSIBLE IN TCCs**	**POSSIBLE IN TSCs**
Telemedicine consultations	12 (92.3%)	4 (100%)
Tele-diagnosis consultations	5 (38.5%)	3 (75%)
CME's	2 (15.4%)	3 (75%)
Inter-professional discussions	3 (23.1%)	2 (50%)
e-health governance	0 (.0%)	2 (50%)
Any other use	0 (.0%)	2 (50%)

(Source: Primary Data)

TABLE 3.6 - TELEMEDICINE ROOM – RELEVANT EQUIPMENT AND CONNECTIONS		
CHARACTERISTIC	**AVAILABLE IN TCCs**	**AVAILABLE IN TSCs**
Relevant equipment and connections	13 (100%)	4 (100%)
Power backup	10 (76.9%)	4 (100%)
Size and Space	12 (92.3%)	4 (100%)
Room Temperature Control	12 (92.3%)	4 (100%)
Acoustics	12 (92.3%)	4 (100%)
Desire type of flooring	13 (100%)	4 (100%)
Required illumination	13 (100%)	4 (100%)
Required colour of room	13 (100%)	4 (100%)

(Source: Primary Data)

Around 69 percent of TCC technicians reported that their telemedicine room was based on guidelines while one-fourth of TSC technicians reported the same. Around 23 percent of TCC technicians and one-fourth of TSC technicians reported of having followed ISRO guidelines for the telemedicine room. The normal duration of the telemedicine room was '8 hours daytime' for 76.9 percent of the TCCs and 25 percent of the TSCs. Only 7.7 percent of TCCs and three-fourths of TSCs worked round the clock (24 hours).

3.3.2.2 TELEMEDICINE DEVICES AND DIAGNOSTIC EQUIPMENT

Nearly 54 percent of TCC technicians and half of the TSC technicians reported that their center had 'problems with telemedicine devices and diagnostic equipment in the last month'.

The equipment providers for all the TCCs and TSCs were ISRO, Televital Inc. and Infinium India Limited. (Refer Tables 32 and 33 in Annexure)

TABLE 3.7 – TELEMEDICINE DEVICES AND DIAGNOSTIC EQUIPMENT PROBLEMS		
Frequency of problems with information technology (IT) hardware	**TCC**	**TSC**
1-2 times/25 consultations	2 (15.4%)	2 (50%)
1-2 times/10 consultations	3 (23.1%)	1 (25%)
1-2 times/5 consultations	8 (61.5%)	1 (25%)
Frequency of problems with connectivity hardware		
Never	1 (7.7%)	0 (.0%)
1-2 times/25 consultations	2 (15.4%)	3 (75%)
1-2 times/10 consultations	5 (38.5%)	1 (25%)
1-2 times/5 consultations	5 (38.5%)	0 (.0%)
Frequency of problems with video conferencing hardware		
Never	1 (7.7%)	0 (.0%)
1-2 times/25 consultations	4 (30.8%)	3 (75%)
1-2 times/10 consultations	4 (30.8%)	0 (.0%)
1-2 times/5 consultations	4 (30.8%)	1 (25%)
Frequency of problems with essential diagnostic hardware		
Never	1 (7.7%)	0 (.0%)
1-2 times/25 consultations	6 (46.2%)	3 (75%)
1-2 times/10 consultations	3 (23.1)	0 (.0%)
1-2 times/5 consultations	3 (23.1%)	1 (25%)
Approximate downtime caused by these equipment problems		
None	1 (7.7%)	1 (25%)
1-2 days	7 (53.8%)	2 (50%)
1 week	5 (38.5%)	1 (25%)
Time taken for service maintenance teams to reach		
Same day	1 (7.7%)	1 (25%)
1 week	6 (46.2%)	3 (75%)
More than a week	4 (30.8%)	0 (.0%)

(Source: Primary Data)

3.3.2.3 CONNECTIVITY

In terms of connectivity, 15.4 percent of TCC technicians reported that their center used ISDN lines for connectivity whereas the majority of 84.6 percent had a VSAT connection. On the other hand, all the TSC technicians reported that their center used VSAT connection and three-fourths of the centers used Broadband connection and ISDN connection additionally along with the VSAT connection. Nearly 54 percent of the TCC technicians and half of TSC technicians reported of having problems in getting connected in the last month. Problems with connectivity occurred 1 to 2 times/25 consultations in 23.1 percent of TCCs, 1 to 2 times/10 consultations in 53.8 percent of the TCCs and 1 to 2 times/5 consultations in 23.1 percent of the TCCs. Problems with connectivity occurred 1 to 2 times/25 consultations in

half of TSCs, 1 to 2 times/10 consultations in one-fourth of TSCs and 1 to 2 times/5 consultations in 25 percent of the TSCs. Nearly 85 percent of the TCC technicians and half of the TSC technicians reported of contacting the 'telemedicine service provider' when they experienced problems getting connected while 7.7 percent of TCC technicians and one-fourth of TSC technicians were contacting ISRO while 7.7 percent of TCC technicians and one-fourth of TSC technicians contacted any other agency in such eventuality. All the TCC technicians and TSC technicians reported of getting immediate assistance from the telemedicine connection provider. (Refer Tables 34 and 35 in Annexure)

3.3.2.4 QUALITY OF IMAGES AND SPEED OF TRANSMISSION

With quality of images, 23.1 percent of TCC technicians reported of encountering problems in the last month while none of the TSC technicians had such an experience. Among these problems, 'hazy pictures' accounted for 7.7 percent. In terms of frequency of these problems, they occurred 1 to 2 times/25 consultations in 30.8 percent of TCCs and in all the TSCs. Problems occurred 1 to 2 times/10 consultations in 7.7 percent of TCCs and 1 to 2 times/5 consultations in 61.5 percent of the TCCs. Problems with the speed of transmission were reported by 30.8 percent of TCC technicians and half of TSC technicians. Among TCCs, 'one-way voice and slow communication' accounted for 7.7 percent while 'slow conversation' accounted for 15.4 percent of the problems listed. Among TSCs, 'frozen images and breaks in video and audio' accounted for one-fourth of the problems listed out. (Refer Tables 36 and 37 in Annexure)

In terms of frequency of problems in speed of transmission as reported by TCC technicians, 1 to 2 times/25 consultations accounted for 38.5 percent, followed by 1 to 2 times/10 consultations at 38.5 percent and 1 to 2 times/5 consultations at 23.1 percent. In terms of frequency of problems in speed of transmission as reported by TSC technicians, 1 to 2 times/25 consultations accounted for 25 percent, followed by 1 to 2 times/10 consultations at

25 percent and 1 to 2 times/5 consultations at 25 percent. 61.5 percent of TCC technicians and all the TSC technicians reported that poor quality of images and reduced speed of transmission hampered the consultation process.

3.3.2.5 SERVICE AND MAINTAINENCE

In terms of service and maintainence, 69.2 percent of the TCC technicians and one-fourth of TSC technicians reported of having an annual maintainence contract with a service agency for service and maintenance. Regarding the average time taken by the service agency to report to the center and inspect the problem, 69.2 percent of the TCC technicians reported the duration as 'within 1 week' whereas three-fourths of TSC physicians reported the duration as 'within 1 to 2 days'. (Refer Tables 38 and 39 in Annexure) The average downtime faced by a TCC when equipment failures occur was 'less than a week' for 53.8 percent of TCCs and the corresponding downtime for TSCs was '1 to 2 days' as reported by all of the TSC technicians. When there were minor equipment breakdowns, 92.3 percent of TCC technicians and half of TSC technicians reported that they would 'report and wait for the service agency'. Another half of TSC technicians reported that they would 'seek assistance from an outside service agency'.

In terms of the level of training to handle minor equipment breakdowns, 84.6 percent of TCC technicians reported of 'not being trained' whereas half of TSC technicians reported being 'somewhat trained' to handle such eventualities. In order to 'ensure that equipment breakdowns are reduced to a large extent', 69.2 percent of TCC technicians and all the TSC technicians used equipment with care to avoid equipment breakdowns. In terms of rating the center for capability and preparedness to handle telemedicine consultations, 61.5 percent of TCC technicians and three-fourths of TSC technicians reported that their center was well serviced and maintained.

CHAPTER 4

CHARACTERISTICS INFLUENCING THE UTILISATION OF TELEMEDICINE

DEFINING UTILISATION:

The total number of telemedicine activities engaged in by every TCC physician for the month of July 2007 was considered for defining utilization, the outcome variable.

Utilization was computed as:

Utilization = Total number of Tele-consultations + Total number of Tele-diagnosis consultations + Number of CME's attended/engaged in during the reference month

Physicians or centers which recorded between 0-20 telemedicine consultations/month were categorized under the 'below optimum' group and physicians and centers that recorded more than 20 telemedicine consultations/month were categorized under the 'optimum utilization' group. This classification was not based on any previous studies but assuming that a physician worked for more than 20 days a month and consulted one case a day, he/she would end up optimally utilizing the facility. Upon cross tabulating the independent variables with 'utilization', certain influences became evident, however, the nature of the study and the small sample size, in spite of including all centers in Karnataka, precluded establishing any statistical relationships.

4.1 CENTER CHARACTERISTICS (ADMINISTRATOR AND TECHNICIAN)

4.1.1. UTILIZATION OF TELEMEDICINE BY TYPE OF CENTER

TABLE 4.1		Utilization levels of telemedicine		
		0-20 consultations /month	>20 consultations /month	Total
Type of Center	TSC	4 (66.7%)	2 (33.3%)	6 (100%)
	TCC	7(53.8%)	6 (46.2%)	13 (100%)
Total		11 (57.9%)	8 (42.1%)	19 (100%)

Cross tabulating the type of center versus utilization levels, it was found that out of the 19 centers, 57.9 percent of them were consulting 'below optimally' whereas 42.1 percent were seen to be 'optimally utilizing' the facility. 46.2 percent of TCCs and 33.3 percent of TSCs had 'optimally utilized' (>20 tele-consultations/month) telemedicine facilities. Thus, more TCCs compared to TSCs were optimally utilizing telemedicine facilities indicating that remote centers were betters users of telemedicine, possibly since they initiate a consultation.

4.1.2 UTILIZATION OF TELE-DIAGNOSTIC CONSULTATIONS BY TYPE OF TM CENTER

TABLE 4.2		Tele-diagnostic consultations utilization levels		Total
		0-20/month	>20/month	
Type of TM Center	Telemedicine Specialty Center (TSC)	4 (66.7%)	2 (33.3%)	6 (100%)
	Telemedicine Consulting Center (TCC)	8 (61.5%)	5 (38.5%)	13 (100%)
Total		12 (63.2%)	7 (36.8%)	19 (100.0%)

(Source: Primary Data)

Cross tabulating the type of center versus utilization levels of tele-diagnostic consultations, it was found that effectively 33.3 percent of TSCs and 38.5 percent of TCCs clocked more than 20 tele-diagnostic consultations in the reference month. Thus, a higher proportion of TCCs were optimally utilizing tele-diagnostic consultations compared to TSCs.

4.1.3 UTILIZATION OF TELMEDICINE IN TELEMEDICINE CENTERS BY THE NUMBER OF PHYSICIANS AVAILABLE

TABLE 4.3 - UTILIZATION BY THE NUMBER OF PHYSICIANS AVAILABLE			
		Utilization Level	
		Below Optimum	Optimal Utilization
Number of Physicians	0-3 physicians	11 (64.7%)	6 (35.3%)
	4-6 physicians	0 (.0%)	2 (100%)
Total		11 (57.9%)	8 (42.1%)

Cross tabulating the number of physicians with utilization level, it was found that all the centers which had '4-6' physicians were 'optimally utilizing' telemedicine well whereas only 35.3 percent of centers which had '0-3' physicians could 'optimally utilize' their centers. It can be pointed out that with higher numbers of physicians; the utilization of telemedicine was correspondingly higher, although with the small sample size no statistical relationship can be made. However, providing adequate numbers of trained physicians to the centers will thus improve telemedicine utilization.

4.1.4 UTILIZATION OF TELMEDICINE IN TM CENTERS BY THE NUMBER OF TECHNICAL SUPPORT PERSONNEL AVAILABLE

TABLE 4.4 - UTILIZATION BY THE NUMBER OF TECHNICIANS AVAILABLE			
		Utilization Level	
		Below Optimum	Optimally Utilized
Number of Technical Support Personnel	0-2 technical support personnel	11 (64.7%)	6 (35.3%)
	3 and above technical support personnel	0 (.0%)	2 (100.0%)
Total		11 (57.9%)	8 (42.1%)

Cross tabulating the number of technical support personnel available at the centers with utilization level, it was found that all centers which had more than 3 technicians 'optimally utilized' telemedicine facilities whereas only 35.3 percent of facilities with '0-2' technicians were able to 'optimally utilize' telemedicine facilities. Here, it is shown that utilization seems to increase as the numbers of technical support personnel increased. Addressing technician shortage at centers can thus improve telemedicine utilization.

4.1.5 UTILIZATION OF TM BY CONNECTIVITY PROBLEMS

TABLE 4.5		Utilization Level		
		0-20 consultations/month	>20 consultations/month	N=16
Connectivity Problems	Yes	8 (88.9%)	1 (11.1%)	9 (100.0%)
	No	6 (85.7%)	1 (14.3%)	7 (100.0%
Total		14 (87.5%)	2 (12.5%)	16 (100.0

When connectivity problems were cross tabulated with utilization levels, as seen in Table 4.5 above, 1 (11.1%) TM center had problems with connectivity in the reference month but managed to record >20 consultations/month whereas only 1 another TM center was able to optimally utilize telemedicine facilities in spite of not having connectivity problems. A slightly higher proportion of TM centers which had no connectivity problems were optimally utilizing telemedicine although the small sample size prevents making any statistical inference. It can be inferred that centers which had no connectivity problems were able to utilize telemedicine slightly better, hence ensuring good connectivity would increase utilization rates.

4. 2 PHYSICIAN CHARACTERISTICS

4.2.1 UTILIZATION OF TM BY PHYSICIAN AWARENESS OF THE USES OF TELEMEDICINE

In order to measure 'physician awareness', the series of questions on 'Awareness' in the Interview Schedule were taken as a checklist for analysis purpose. Every positive response was given a score of 1 and 'awareness' was measured on a 15-point scale with the following interpretation for the cumulative score.

TABLE 4.6 - AWARENESS CATEGORISATION	
SCORE	INTERPRETATION
0-8	LOW AWARENESS
9-12	MODERATE AWARENESS
13-15	HIGH AWARENESS

TABLE 4.7 - UTILIZATION BY PHYSICIAN AWARENESS OF USES OF TM			
AWARENESS LEVEL		Utilization Level	
		Below Optimal	Optimal Utilization
Awareness level	Moderate Awareness	5 (71.4%)	2 (28.6%)
	High Awareness	7 (100.0%)	0 (.0%)
Total		12 (85.7%)	2 (14.3%)

When physician awareness levels were cross tabulated with utilization levels, it was found that 28.6 percent of those physicians who were 'moderately aware' regarding telemedicine had optimally utilized telemedicine facilities whereas none of those physicians who were 'highly aware' regarding telemedicine had optimally utilized the facilities. An intriguing observation that staff who were well-versed in TM were utilizing it less compared to less-versed staff is evident here. The numbers are, however, far too less to establish any statistical relationship.

4.2.2 UTILIZATION OF TELEMEDICINE BY PHYSICIAN ATTITUDE TO TM

In order to measure 'physician attitude towards telemedicine', positive responses for selected questions in the series of questions on 'Acceptance of telemedicine as an useful and easy to use tool', 'Perceived need for telemedicine' and the section on 'Willingness to use telemedicine' were awarded 1 point each and a scale designed to measure the cumulative score for 'attitude of the physician' with the interpretation given below.

TABLE 4.8 – PHYSICIAN ATTITUDE TOWARDS TM CATEGORISATION	
SCORE	INTERPRETATION
0-6	MODERATE ATTITUDE TO USE TELEMEDICINE
7-9	POSITIVE ATTITUDE TO USE TELEMEDICINE

TABLE 4.9 - UTILIZATION BY PHYSICIAN ATTITUDE TO TELEMEDICINE			
		Utilization Level	
		Below Optimal	Optimal Utilization
Attitude Levels	Moderate attitude to use telemedicine	7 (100.0%)	0 (.0%)
	Positive attitude to use telemedicine	5 (71.4%)	2 (28.6%)
Total		12 (85.7%)	2 (14.3%)

When physician attitude levels were cross tabulated with utilization levels, it was found that 28.6 percent of TCC physicians who had a positive attitude to use telemedicine had 'optimally utilized' the telemedicine facility compared to none of the TCC physicians who had moderate attitude to use telemedicine. Thus, physicians having a positive attitude to telemedicine were more likely to utilize telemedicine optimally. The relatively small numbers preclude establishing a statistical relationship. Modifying physician attitude towards telemedicine positively would make telemedicine utilization increase.

4.2.3 UTILIZATION OF TELMEDICINE BY THE NEED FOR INCENTIVES (AS EXPRESSED BY PHYSICIANS)

TABLE 4.10 - INCENTIVES CATEGORISATION	
SCORE	INTERPRETATION
0-3	MODERATE NEED FOR INCENTIVES
4-7	HIGH NEED FOR INCENTIVES

In order to measure the 'need for incentives' as felt by the physician, the positive responses obtained from the series of questions on 'Incentives to use telemedicine', were awarded 1 point each and a 7- point scale was designed to interpret the cumulative score obtained as below.

TABLE 4.11 - UTILISATION OF TELMEDICINE BY THE NEED FOR INCENTIVES			
		Utilization Group	
		Below optimal	Optimal Utilization
Incentive Need	Moderate need for incentives	11 (91.7%)	1 (8.3%)
	High need For incentives	1 (50.0%)	1 (50.0%)
	Total	12 (85.7%)	2 (14.3%)

When the need for incentives was cross tabulated with utilization levels, it was found that 50 percent of TCC physicians who had a 'high need for incentives' had 'optimally utilized' telemedicine consultations in the last month. This seems to indicate that those who have been optimally utilizing telemedicine would expect incentives to a greater degree than those who have not been optimally utilizing. Most of the physicians ended up in the 'moderate need for incentives' group with only 8.3 percent of them optimally utilizing optimally. The numbers are however far too less to establish a statistical relationship.

4.2.4 UTILIZATION OF TELEMEDICINE BY PATIENT NEEDS (AS FELT BY THE PHYSICIAN)

TABLE 4.12 - UTILISATION OF TELMEDICINE BY PATIENT NEEDS			
		Utilization Level	
		Below optimal	Optimally Utilized
Most common reason for consulting the TCC?	When patient cannot be managed without specialist consultation	4 (80.0%)	1 (20%)
	When it is not feasible to refer the patient to a specialty center	1 (50.0%)	1 (50.0%)
	To consult regarding a rare disorder or condition	6 (100.0%)	0 (.0%)
Total		12 (85.7%)	2 (14.3%)

When utilization levels were cross tabulated with the patient needs as felt by the physician, 85.7 percent of TCC physicians who recognized various 'patient needs' for telemedicine were 'below optimally' utilizing telemedicine whereas only 14.3 percent of physicians who recognized patients needs for telemedicine were 'optimally utilizing' telemedicine. Although patient needs do seem to make physicians use telemedicine, the degree of utilization might not entirely depend on patient needs but on certain individual and center characteristics.

4.2.5 UTILIZATION OF TELEMEDICINE BY PHYSICIAN SATISFACTION WITH TM CONSULTATIONS

'Satisfaction with telemedicine consultations' for every TCC physician was measured by awarding 1 point for all positive responses to the 'satisfaction with telemedicine consultations' section of the interview schedule. The cumulative score obtained for every physician was interpreted using the scale given below.

TABLE 4.13 – PHYSICIAN SATISFACTION CATEGORISATION	
SCORE	INTERPRETATION
0-9	MODERATE SATISFACTION
10-15	HIGH SATISFACTION

TABLE 4.14 - UTILIZATION BY PHYSICIAN SATISFACTION WITH CONSULTATIONS			
		Utilization Levels	
		Below optimal	**Optimal utilization**
Satisfaction Levels	Moderate Satisfaction	7 (87.5%)	1 (12.5%)
	High Satisfaction	5 (83.3%)	1 (16.7%)
Total		12 (85.7%)	2 (14.3%)

When satisfaction levels with telemedicine consultation was cross tabulated with utilization level, it was found that 16.7 percent of those physicians who expressed 'high satisfaction with telemedicine consultations' had 'optimally utilized' telemedicine services well whereas only 12.5 percent of physicians who reported of 'moderate satisfaction with telemedicine consultations' had 'optimally utilized' telemedicine services. Thus, a higher proportion of

physicians who were highly satisfied with TM consultations were optimally utilizing telemedicine facilities. The numbers are however far too less to establish a statistical relationship.

4.2.6 UTILIZATION OF TELMEDICINE BY HIGHEST EDUCATION OF THE PHYSICIAN

TABLE 4.15 - UTILIZATION BY HIGHEST EDUCATION OF THE PHYSICIAN			
		Utilization Level	
		Below optimal	Optimally utilized
Education level	MBBS Degree	3 (33.3%)	0 (.0%)
	PG diploma/MD/MS	9 (66.6%)	2 (16.6%)
Total		12 (83.4%)	2 (16.6%)

When highest education of the physician was cross tabulated with utilization levels, it was found that 16.6 percent of physicians who were PG diploma/MD/MS qualified utilized telemedicine optimally compared to none of the MBBS qualified physicians. Thus, we see that higher qualified physicians tend to optimally utilize telemedicine facilities. The numbers are however far too less to establish a statistical relationship.

4.2.7 UTILIZATION OF TELEMEDICINE BY TRAINING RECEIVED

4.2.7.1 UTILIZATION OF TELEMEDICINE BY DURATION OF TRAINING RECEIVED BY THE PHYSICIAN

TABLE 4.16 - UTILIZATION BY DURATION OF TRAINING RECEIVED BY THE PHYSICIAN			
		Utilization Level	
		Below optimal	Optimally utilized
What was the training period?	Less than 1 day	0 (.0%)	1 (100%)
	2-3 days	12 (92.3%)	1 (7.7%)
Total		12 (85.7%)	2 (14.3%)

When the duration of training was cross tabulated with utilization levels, it was found that only 1 TCC physician out of 12 who had been trained for 2-3 days 'optimally utilized' telemedicine facilities. Majority of the physicians (85.7 percent) were trained for 2-3 days but

ended up utilizing telemedicine 'below optimally'. The numbers are however far too less to establish any statistical relationship.

4.2.7.2 UTILIZATION OF TELEMEDICINE BY LEVEL OF TRAINING RECEIVED BY THE PHYSICIAN

TABLE 4.17 - UTILIZATION BY LEVEL OF TRAINING RECEIVED BY THE PHYSICIAN			
		Utilization Levels	
		Below optimal	Optimally Utilized
What is the level of training that you have obtained?	Untrained	2 (100%)	0 (.0%)
	Less than adequate	4 (66.7%)	2 (33.3%)
	Adequate	5 (100.0%)	0 (.0%)
	More than adequate	1 (100.0%)	0 (.0%)
Total		12 (85.7%)	2 (14.3%)

When the level of training was cross tabulated with utilization levels of telemedicine as in Table 4.17, rather surprisingly it was found that 33.3 percent of TCC physicians who had been trained 'less than adequately' managed to 'optimally utilize' telemedicine whereas the adequately and more than adequately trained physicians did not consult optimally.

4.2.8 UTILIZATION OF TELEMEDICINE BY THE RELATIONSHIP OF THE PHYSICIAN WITH TSC PHYSICIANS

In order to measure the degree of inter-personal relationships, every positive response obtained to the series of questions on 'relationship with the TSC physician and other specialist physicians' was awarded 1 point and the cumulative score obtained was interpreted in the following manner:

TABLE 4.18 - RELATIONSHIP BETWEEN PHYSICIANS CATEGORISATION	
SCORE	INTERPRETATION
0-5	NOT VERY FAMILIAR
6-9	PERSONAL ACQUAINTANCE

TABLE 4.19 - UTILIZATION BY THE RELATIONSHIP WITH TSC PHYSICIANS			
		Utilization Level	
		Below Optimal	Optimally Utilized
Relationship between physicians	Not very familiar	3 (100.0%)	0 (.0%)
	Personal Acquaintance	9 (81.8%)	2 (18.2%)
Total		12 (85.7%)	2 (14.3%)

When relationship with TSC physicians was cross tabulated with utilization level, it was found that 18.2 percent of physicians who had a personal acquaintance at the TSC were optimally utilizing telemedicine facilities. Hence, it follows that having a personal acquaintance at the other end was enabling physicians to optimally utilize telemedicine facilities. Encouraging interaction between both groups of physicians through conferences/workshops can enable physicians to know each other and utilize telemedicine better.

4.2.9 UTILIZATION OF TM AGE GROUP OF THE PHYSICIANS

When Age Group of the physicians was cross tabulated with utilization levels (refer Table 4.20 below), it was found that 2 out of 9 physicians among the 41-60 years age group were consulting 'optimally' as compared to none from the 0-40 years Age Group. It shows that physicians in the age group of 41 to 60 years were optimally utilizing telemedicine facilities. The numbers in each cell were however far too less to establish a statistical relationship.

TABLE 4.20 - UTILIZATION BY AGE GROUP OF THE PHYSICIAN			
		Utilization Group	
		Below Optimal	Optimally Utilized
Age Group	0-40 years	5 (100.0%)	0 (.0%)
	41-60	7 (77.8%)	2 (22.2)
Total		12 (85.7%)	2 (14.3%)

CHAPTER 5 DISCUSSION

5.1 CONCLUSIONS

To sum up the findings of this study, it was found that a large proportion of TCCs and TSCs were 'below optimally' utilizing telemedicine although to quantify telemedicine consultations as optimal and sub-optimal was a challenge in itself. Physician characteristics that influenced utilization included awareness of the physician regarding telemedicine, physician attitude towards the use of telemedicine, physicians' need for incentives, patient needs as felt by the physician, physician satisfaction with the telemedicine consultation, highest education of the physician, age of the physician, and relationship/rapport with other physicians.

It has been noted in the study that in terms of physician attitude (willingness to use, acceptance and ease of use) most of the physicians accepted telemedicine, but it did not translate into optimal utilization. This finding has been highlighted in literature available including the study by Fitzgerald P et al, 2003, and the study by Reardon T, 2005, which suggested that physician attitude had a significant bearing on the utilization of telemedicine. However, other factors such as awareness, time available, motivation of the physician to connect to begin a consultation, the motivation of the technical and administrators to keep the telemedicine unit functional were influencing the physician's degree of utilization. A majority of physicians expressed the desire to utilize telemedicine more regularly and expand it to other specialties too, but did not have the time or an incentive structure to support. Incentives have been recognized as important parameters across various studies such as the study by Sheshadri et al, 2005, and Puskin D et al, 1995, and this only goes on to prove that in presence of incentives – be it recognition, rewards of career growth, monetary rewards or a combination of any of them, telemedicine utilization will increase. Training was found to be deficient for all levels of staff and this has a direct influence on the center's capability to consult regularly on a long term basis. Correspondingly, Sheng et al, 1999 and Hu PJ, 1999

have mentioned that training of the physician in telemedicine had an important effect on utilization. Although physicians recognized patient needs and many did consult based on the need, telemedicine was not generally preferred due to lack of time and manpower constraints. Verschueren L, 2006, and Whitten P, Franken EA, 1995, have noted that patient needs will dictate utilization. Satisfaction with telemedicine consultations was an important parameter which encouraged physicians to revisit the telemedicine room. Once a physician felt it was not satisfying, he would generally not wish to consult again. Similarly, Sheng et al, 1999 and Hu PJ, 1999 have also documented that satisfaction with the telemedicine consultation increases utilization. In studies by Doolittle GC, Cook D, 1999 and Yellowlees P, 1997, the relationship between remote and specialist physicians was found to be a crucial factor influencing telemedicine utilization. In this study, for TCC physicians, it was more of an assurance to tele-consult with a known physician at the TSC, probably because there was no delineation of hierarchy and remote physicians felt confident when the specialists were known, approachable and easy to consult with.

Center characteristics that were found to play an important role in the utilization of telemedicine include the presence of a functioning telemedicine room, devices, connectivity, and shortage in numbers of staff – physicians, nurses, paramedical staff and technical support personnel. Without adequate manpower, almost every administrator had to manage with the existing resources. Most often, due to lack of a technician, the telemedicine room remained completely non-functional. A designated schedule for telemedicine room duty was absent at all TCCs. Telemedicine costs and the sustenance factors were important factors as government centers could not even foresee working without governmental assistance. Many centers were planning to introduce 'user fees' but the introduction of user fees has decreased patient load at many hospitals and hence might be counterproductive. Corporate and trust hospitals, however, had the capacity to raise funds and manage their telemedicine units

without much assistance from the government. Connectivity was also a major limiting factor as many personnel felt connecting took a lot of time and the time lost was crucial to the patient many times. It also compromised the physician's ability to complete this task and move onto another. Similar to the study by Paulich M (2003) on organizational characteristics affecting telemedicine utilization (114), the majority of successful telemedicine programs had efficient administrative staff who provided leadership, and technicians to keep the equipment well maintained and up-to-date. Utilization at referring sites was limited by inadequate manpower, outdated equipment, and unclear objectives. In the presence of motivation from a physician in a leadership position, many centers were able to overcome these limitations. Without administrative and physician leadership, telemedicine utilization is not very high and the regularity cannot be sustained. Further, it has been shown that physicians who had personal acquaintances at the specialty center were optimally utilizing telemedicine, thus knowing the physician at the other end made the consultation process much desirable.

5.2 CURRENT PATTERNS OF TM UTILIZATION IN KARNATAKA

The present utilization of telemedicine in the Karnataka ISRO telemedicine project is clearly 'below optimum' with a urgent need to upscale and increase the variety and number of consultations. What came out apart from the numbers in the process of interviewing and talking to physicians, technicians and administrators was that most of the staff were keen on utilizing telemedicine and making it a part of daily practice, but time constraints, staffing issues and lack of incentives seem to be diminishing their zeal. At the moment, the main tele-diagnostic activity is centered around sending ECG readings of patients to Narayana Hrudayalaya (the main TSC and designated TSC for Cardiology) where a dedicated team of full-strength telemedicine staff exist. The physician reads and sends back the ECG report with recommendations for treatment and monitoring. If the patient is very critical, he/she would be stabilized at the TCC and then transported to a nearby TSC or to Narayana

Hrudayalaya itself for treatment. Unfortunately, the other specialty centers, barring Vittala Institute of Ophthalmology, which engages in tele-ophthalmologic screening and medical and surgical management of eye ailments through their mobile telemedicine van at designated centers around Karnataka State, were not engaging in telemedicine at all. JSS Medical College Hospital, Mysore, which was the TSC for Nephrology had not been functioning since a year as the Nephrologist who was trained in telemedicine had quit. St. John's Medical College, Bangalore (the designated TSC for Pediatrics) and Samatvam Institute of Diabetology (designated TSC for Diabetology) were non-functional as of July 2007 as the connectivity had not been provided and administrators felt offering specialist consultations would bring them nothing in return. NIMHANS, Bangalore (designated TSC for Neurology and Mental Health) had been connected using a ISDN line, but time constraints of busy government hospital physicians and the location of the TM center in the library complex (which was away from the hospital) had resulted in nobody using the center. From the TCC point of view, the only accessible and fully functional TSC was Narayana Hrudayalaya and as this center is a cardiac hospital, most of the teleconsultations and tele-diagnosis consultations were centered around Cardiology. Only a few of the TCCs had attended CME's conducted by Narayana Hrudayalaya and Vittala Institute of Ophthalmology. Other TSC centers are in the process of being connected through VSAT and the variety of specialist consultation available is bound to go up eventually. Most of the Government TCCs were uniform in structure and manpower patterns; all of them had unfilled positions, physicians were highly burdened, many physicians were disinterested to say the least and the heavy patient loads prevented them from making time for telemedicine consultations. Some physicians even expressed concerns about the legal implications in the event of an untoward incident to a patient while being treated/monitored through telemedicine consultations from a TSC. It was noted that in most TCCs, the Intensive Care Unit (ICU) which was specially

provided for the telemedicine center was not being used and the older ICU which was away from the TM room was still being used.

5.3 CENTER BARRIERS TO UTILIZATION

The major issues that cause concern at the center level according to this study have been inability to ensure proper scheduling of duties for physicians, lack of incentives such as career-growth or financial perks, poor technical support, lack of regular training, costs and sustenance issues, lack of time for telemedicine, and relationship or rapport with the specialty physicians. In support of the study findings, Grisgsby J, 2007 and Paulich et al, 2003, had noted that adequate manpower (physicians, administrators, technical support personnel and nurses) were required to ensure optimum utilization. Minztberg, 1979 and DiMaggio P et al 1983 had pointed out that suitable organization structures, manpower and leadership can support utilization of technology in healthcare settings. From the study, centers which had shortage of trained staff, had untrained staff, lack of administrative willingness to engage in telemedicine, difficulty in managing the costs of maintaining the telemedicine center or had trained specialist physicians at their very end were 'below optimally' utilizing telemedicine. Weinstock M et al, 2002 and Hu PJ, 1999 have explored the service and maintenance issue and how it affects overall telemedicine utilization. When downtimes were high, invariably the operational preparedness of the center was affected and utilization went down. Centers which had problems in the quality of images or the speed of transmission were also below optimally utilizing telemedicine facilities. Similarly, in studies done by Sibson L, 1999 and Kennedy C, 2003 it has been pointed out that the quality of the images and speed of transmission were crucial to the overall telemedicine experience and aided utilization.

5.4 PHYSICIAN BARRIERS TO UTILIZATION

Physicians were the most important manpower entity affecting the utilization of telemedicine at any of the TCC or TSC centers. Physicians were honestly unable to make time for telemedicine consultations; often the telemedicine room was located in a corner of the hospital away from the normal wards and ICU. The ICU connected to the telemedicine room was often non-functional. Chau and Hu (1999) have suggested in their study that the physicians' decision to adopt telemedicine depends on its relevance with the physicians' current work practice', thus supporting this finding. Physician attitude towards telemedicine was found to be a combination of willingness to use, acceptance of the technology and comfort levels while interacting with telemedicine technology. Satisfaction with the telemedicine consultation was another factor which was difficult defining and although most physicians expressed satisfaction with the quality of telemedicine consultation and clinical outcomes, there were fears of legal implications of tele-consultations and responsibility for health care provided to a patient. Some of the specialists at District Hospitals felt they could handle and treat a patient on their own and thus ignored obtaining a second opinion. Some of these physicians were also administrators of the telemedicine unit and hence those who were not convinced about the application and need to tele-consult were barriers to physicians utilizing telemedicine. This finding has been also reported in another study which states 'management and administrative opinions have the potential to affect providers' thoughts about telemedicine. Supervisors who fail to understand the application and abilities of telemedicine can make its use difficult for healthcare workers.(62) Another major finding was a clear cut difference between private and public institutions' utilization of telemedicine. The general understanding based upon the interaction with these centers is that private institutions used telemedicine for the promotion of their organization and interpreted participation in the telemedicine program as their social responsibility.

5.5 *STRENGTHS AND LIMITATIONS OF THE STUDY*

5.5.1 *STRENGTHS*

1. The appropriateness of the study is the biggest strength, coming at a time when India is launching telemedicine projects across all states and at a time when the ISRO telemedicine project in Karnataka is into its 5th year of operation; a good opportunity to make mid-term corrections based on the findings in this study.
2. The study involved all the 19 functional centers under the ISRO project in Karnataka and hence completely representative of the state.
3. ISRO and the Government of Karnataka took keen interest in this study and supported the researcher in obtaining permission and access to all resources and facilities.
4. The public health relevance of this study; being the first of its kind and unique in its approach in looking at provider and setup characteristics. This was different from the general trend of looking at patient satisfaction with telemedicine.
5. Coming forth from SCTIMST, an institute which stands for the combination of medical sciences and technology, this study was important in this era of increasing technology in healthcare and a much relevant one.

5.5.2 *LIMITATIONS*

1. The nature of the study and the fewer number of respondents made it impossible to go in for sophisticated statistical analysis. However, the findings of this study can serve as a catalyst for larger studies thereby overcoming the inherent limitation of a small study such as this one.
2. The study missed qualitative aspects which could have provided more evidence and substantiated the findings even in the absence of sufficient numbers.
3. Given the short period of 3 months for data collection and the enormous travel involved, sometimes more than 750 kilometers from the city of origin, time was at a premium.

5.6 *RECOMMENDATIONS*

In order to ensure optimal utilization of telemedicine, it is necessary to address issues of manpower shortage, training, incentives, and connectivity. As connectivity is just one of the elements in telemedicine, ISRO will need to look beyond connectivity and partner with the Karnataka State Health and Family Welfare Department in addressing the issues that lead to poor utilization. The Karnataka State Health Department will need to comprehensively plan and appoint designated telemedicine staff who will not be burdened with other hospital duties. At the end of this study, the numbers of consultations do not seem to be an important cornerstone, as even one good tele-consultation can benefit a patient's life. Doing away with the target-driven approach, telemedicine needs to be integrated into the health care setup to become a part and parcel of everyday clinical routine. Career-incentives or financial perks to encourage staff to utilize telemedicine, regular maintenance of equipment and ensuring continuous connectivity will help achieve the goals of utilization and integration into the health system. Interacting with all stakeholders and communicating directly with the remote sides to find out their needs is necessary. Some degree of thought should also go into how physicians feel about computers and technology and how they can be modified. Another general criticism to telemedicine in India is that it is an application thrust upon by the service providers, i.e., either agencies which are providing connectivity or the organizations which have software and hardware solutions for telemedicine. As these are perceived to be 'ICT agencies', they have not been well accepted by the physician community. There is also criticism that these organizations do not take into consideration the perceptions of the users such as the physicians. It has also been noted that most published literature on telemedicine in India is either from ISRO or DIT (both ICT agencies) with very few studies coming from the medical or physician community. Telemedicine will sustain and the utilization will be fairly encouraging when the physicians and public medical institutions take up ownership for it. It is thus very important that they are involved in every step of the planning process.

The long term recommendations for integrating telemedicine and increasing utilization are:

- To encourage tele-consulting with a specialist physician for all those clinical procedures and conditions for which care/treatment can be provided remotely by the local physician.
- Effective training and followup training should be provided to the specialist physicians and local physicians with the aim to reduce medical errors in diagnosis and management. Failures will keep away patients and distance physicians from the technology and reduce utilization.
- Strengthening of existing rural health care facilities with the integration of telemedicine into routine clinical practice is necessary.
- There is an utmost need for good management of the project and hence dedicated project managers should be appointed to head the project either district-wise or geographic-sector wise to ensure that the project delivers the expected outcomes.
- The committee for telemedicine coordination should include all the stakeholders and representatives from all the local and specialist centers.
- Organizing frequent interactions such as workshops/conferences will help improve relationship and rapport between remote and specialty centers and physicians.
- Regular training of the users of technology – physicians primarily is essential to prepare a wide user base. Regular training of technical support personnel and administrators on the latest advancements is necessary to ensure that technical barriers are minimized.
- Telemedicine equipment and connectivity should be provided free of charge, as it is currently, for some more time until the centers are capable of managing their own telemedicine units.

REFERENCES

1. Yellowlees P, Brooks P. Health online: the future isn't what it used to be. *Medical Journal of Australia* 1999; 171:522-525.
2. CHIC Ltd. *Australian E-Health 2002 (report summary).* Available:[www.health.nsw.gov.au/pmd/telemedicine/main_4/news/pdf/CHICReport.pdf] (April 15, 2007).
3. NHIMAC 1999. *Health On-Line: a health information action plan for Australia*, Available: [http://www.health.gov.au/healthonline] (April 11, 2007).
4. Chismar WG, Wiley-Patton S. Does the extended technology acceptance model apply to physicians', in *36th Hawaii International Congress on System Sciences (HICSS'03)* 2003, IEEE Computer Society, Big Island, Hawaii.
5. Dearne K. Health's tech bypass. In *The Australian* 2003; 1, 4. Sydney.
6. Murray D. Healthcare challenge. In *Australian Information Week* 2003;3: 10-18.
7. Wenn A, Tatnall A, Sellitto C, Darbyshire P and Burgess S. A sociotechnical investigation of factors affecting I.T. adoption by rural GPs. In *Information Technology in Regional Areas. Using IT: Make IT Happen* 2002, Online, Rockhampton, Queensland Australia.
8. Western M, Dwan K, Makkai T, del Mar C and Western J.*Measuring IT use in Australian GeneralPractice* 2003, University of Queensland, Australia.
9. Fitzgerald, P., Aitken, J. and Krauss, I. *HealthConnect interim research report: volume 1 overview and findings* 2003, Department of Health and Aging, Canberra, ACT.
10. Kaplan B and Shaw NT. People, organisational, and social issues: evaluation as an exemplar', in *Yearbook of Medical Informatics* 2002, eds. R, H. and C, H., Stuttgart: Shattauer; pp. 71-88.
11. Khoumbati K, Themistocleous M and Irani Z. The Adoption of Enterprise Application Integration inHealthcare Organisations: Methodological Perspective, In Gallette, D and Ross, J (eds), *Proceedings of Tenth Americas Conference on Information Systems*, New York, 2004:268-277.
12. Bashshur RL, Reardon TG and Shannon GW. Telemedicine : A new health care delivery system. *Annual Review of Public Health* 2000; 21: 613-637.
13. Perednia DA and Allen A. Telemedicine technology and clinical applications. *Journal of the American Medical Association* 1995; 273:483-487.
14. Bangert D, Doktor R and Warren J. Introducing telemedicine as a strategic intent. 32nd *Hawaii International Conference on System Sciences* 1999, Maui : IEEE Computer Society.
15. Aas IHM. A qualitative study of the organizational consequences of telemedicine. *Journal of Telemedicine and Telecare* 2001; 7:18-26.
16. May CR, Gask L, Atkinson T, Ellis N, Mair FS and Esmail A. Resisting and promoting new technologies in clinical practice : the case study of telepsychiatry. *Social Science and Medicine* 2001; 52:1889-1901.

17. Croteau A-M and Vieru D. Telemedicine adoption by different groups of physicians. *35th Hawaii International Conference on System Sciences* 2002, Maui : IEEE Computer Society.
18. Hu PJ, Chau PYK, Liu Sheng OR, Yan Tam K. Examining the Technology Acceptance Model Using Physician acceptance of Telemedicine Technology. *Journal of Management Information Systems* 1999; 16:91- 112.
19. Doolittle G C, Cook D. Defining the needs of a telemedicine service. *Introduction to Telemedicine* (ed[s]. Wotton R, Craig J). Royal Society of Medicine Press, London, England, 1999. (Accessed: March 10, 2007).
20. Office of the Advancement of Telemedicine. So what is telemedicine? [Website] 2005 [cited 2005 June 5]; OAT Website]. Available from: http://telemedicine.hrsa.gov/welcome.htm.
21. Fitzpatrick R. Surveys of patient satisfaction: Important general considerations. BMJ 1991;302:887-9.
22. Trout A, Magnusson A, Hedges J. Patient Satisfaction Investigations and the Emergency Department. Academic Emergency Medicine, 2000;7:695-709.
23. Trout A, Magnusson A, Hedges J. Patient Satisfaction Investigations and the Emergency Department. Academic Emergency Medicine, 2000;7:695-709.
24. Johnson E. Telemedicine: An annotated bibliography, part II. Telemedicine Journal 1995;1:257-292.
25. Grigsby J, Sanders J. Telemedicine: Where it is and where it's going. Annals of Internal Medicine 1998;129:123-127.
26. Hersh W. Telemedicine for the Medicare population, Agency for Healthcare Research and Quality, Editor. 2001.
27. Bashshur R. Telemedicine effects: Cost, quality and access. Journal of Medical Systems 1995;19:81-91.
28. Fitzpatrick R. Surveys of patient satisfaction: Important general considerations. BMJ 1991;302:887-9.
29. Donabedian A. The Quality of Care: How Can It Be Assessed? JAMA 1988;260:1743-8.
30. Larsen F. Implementing telemedicine services in northern Norway: barriers and facilitators. J Telemed Telecare 2003;9:17-8.
31. Johansen M. A feasibility study of email communication between the patient's family and the specialist burns team. J Telemed Telecare 2004;9:53-9.
32. Larsen F. Implementing telemedicine services in northern Norway: barriers and facilitators. J Telemed Telecare 2003;9:17-8.
33. Larcher B. An evaluation of the user and user satisfaction with a teleconsultation system in oncology practice. J Telemed Telecare 2002;8:28-30.
34. Richards H. Remote working: survey of attitudes to e-health of doctors and nurses in rural general practices in the United Kingdom. Family Practice 2005 (Jan. 10).

35. Malone P. Clinical care and education for trauma using telemedicine: Overcoming barriers to implementation and use. Telemed J E Health 2003;9:41.
36. Russell T. Rehabilitation after total knee replacement via low-bandwidth telemedicine: the patient and therapist experience. J Telemed Telecare 2004;10:85-7.
37. Wallace DL, Smith RW, Telemedicine-assisted referrals to a plastic surgery trauma service. J Telemed Telecare 2003;9:89.
38. Bensink M. Pediatric pallative home care with Internet-based video-phones: lessons learnt. J Telemed Telecare 2004;9:10-3.
39. Krupinski E. Clinical applications in telemedicine/telemedicine. Telemed J E Health 2002;8:13-34.
40. Lopez A. Increasing access to care via tele-health: The Arizona experience. Journal of Ambulatory Care Management 2005;28:16-23.
41. Anderson G. A patient-centered health care delivery system by a university obstetrics and gynecology department. Obstetrics and gynecology 2005;105:205-10.
42. Mair F, Whitten P. Systematic review of studies of patient satisfaction with telemedicine. BMJ 2000;320:1517-20.
43. Larcher B. An evaluation of the user and user satisfaction with a teleconsultation system in oncology practice. J Telemed Telecare 2002;8:28-30.
44. Richards H. Remote working: survey of attitudes to e-health of doctors and nurses in rural general practices in the United Kingdom. Family Practice 2005 (Jan. 10).
45. Kennedy C. Determining clinician satisfaction with telemedicine. J Telemed Telecare 2003;9:62-4.
46. Larsen F. Implementing telemedicine services in northern Norway: barriers and facilitators. J Telemed Telecare 2003;9:17-8.
47. Larcher B. An evaluation of the user and user satisfaction with a teleconsultation system in oncology practice. J Telemed Telecare 2002;8:28-30.
48. Collins K, Walters S, Bowns I. Patient satisfaction with teledermatology: Quantitative and qualitative results from a randomized controlled trial. J Telemed Telecare 2004;10:29-33.
49. Larcher B. Analysis of user satisfaction with a teleconsultation system in oncology. Medical Informatics and the Internet in Medicine, 2003;28:73-84.
50. Cook DJ, Doolittle GC, Ferguson D, Hanks N, Hood J, Howard M, *et al* . Explaining the adoption of telemedicine services: An analysis of a paediatric telemedicine service. J Telemed Telecare 2002;8:106-7.
51. Hicks L, Boles K, Hudson S, Kling B, Tracy J, Mitchell J, Webb W. Development of a telemedicine evaluation model. Presentation at the NLM Symposium on Telemedicine and Telecommunications: Options for the New Century. Bethesda, MD: National Institutes of Health 2001, March 13-14.
52. Kavanaugh S. Telemedicine: Clinical applications in mental health. Australian Family Physician 1995;24:1242-7.

53. Nesbitt T. Development of a telemedicine program: a review of 1,000 videoconferencing consultations. Western Journal of Medicine 2000;173: 169-74.
54. Johansen M. A feasibility study of email communication between the patient's family and the specialist burns team. J Telemed Telecare 2004;9:53-9.
55. Whited J. Patient and clinician satisfaction with a store-and-forward teledermatology consult system. TTelemed J E Health 2004;10:422-31.
56. Sibson L. The virtual mole clinic: Preliminary results from the Plymouth skin cancer screening study using telemedicine. Medical Informatics and the Internet in Medicine, 1999;24:189-99.
57. Demartines N. Assessment of telemedicine in surgical education and patient. Annals of Surgery, 2000;231:282-91.
58. Gilmour E. Comparison of teleconsultations and face-to-face consultations: Preliminary results of a United Kingdom multicenter teledermatology study. Br J Dermatol 1998;139:81-7.
59. Kennedy C. Determining clinician satisfaction with telemedicine. J Telemed Telecare 2003;9:62-4.
60. Rotvold G. Telemedicine screening for diabetic retinopathy: staff and patient satisfaction. J Telemed Telecare 2003;9:109-13.
61. Made C. Tele-otolaryngology consultations between two rural primary-care centers in southern Lapland and the University Hospital of Umea. J Telemed Telecare 1999;5:93-4.
62. Cook DJ, Doolittle GC, Ferguson D, Hanks N, Hood J, Howard M, *et al* . Explaining the adoption of telemedicine services: An analysis of a paediatric telemedicine service. J Telemed Telecare 2002;8:106-7.
63. Hu PJ, Chau PYK and Sheng OL. Investigation of factors affecting healthcare organization's adoption of telemedicine technology. *33rd Hawaii International Conference on System Sciences* 2000, Maui : IEEE Computer Society.
64. Davis F. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, *MIS Quarterly* 1989; 13:319-339.
65. Ajzen I. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 1991, 50, 179-211.
66. Al-Gahtani SS and King M. Attitudes, satisfaction and usage: factors contributing to each in the acceptance of information technology. *Behaviour and Information Technology* 1999;18:277-297.
67. Davis F. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, *MIS Quarterly* 1989; 13:319-339.
68. Kidd MR and McPhee W. The lost generation: IT education for healthcare professionals', *MedicalJournal of Australia* 1999;171:510-511.
69. Mitchell J. *From telemedicine to E-health: The unstoppable rise of E-health* 1999, Available: [http://www.onlineaustralia.net.au/Projects/ecommerce/ehealth/rise_of_ehealth/unstoppable_rise.htm] (March 20).

70. NHIMAC 1999, *Health On-Line: a health information action plan for Australia*, Available:[http://www.health.gov.au/healthonline] (July 11).

71. Weinstock M, Nguyen F, Risica P. Patient and referring provider satisfaction with teledermatology. J Am Acad Dermatol 2002;47:68-72.

72. Doolittle G C, Cook D. Defining the needs of a telemedicine service. *Introduction to Telemedicine* (ed[s]. Wotton R, Craig J). Royal Society of Medicine Press, London, England, 1999. (Accessed: March 10, 2007).

73. Doolittle G C, Cook D. Defining the needs of a telemedicine service. *Introduction to Telemedicine* (ed[s]. Wotton R, Craig J). Royal Society of Medicine Press, London, England, 1999. (Accessed: March 10, 2007).

74. Yellowlees P. Successful development of telemedicine systems: Seven core principles. Journal of Telemedicine and Telecare, 1997, 3(4): 215-23. (Accessed: March 10, 2007).

75. Grigsby J. You got an attitude problem, or what? Telemedicine Today, 1995, 3(3): 32-3. (Accessed: March 10, 2007)

76. Sheshadri HS, Kandaswamy A. Telemedicine Technology-An overview. *Calicut Medical Journal* 2005; 3:3.

77. Puskin D, Brink L, Mintzer C, Wasem C. Joint Federal Initiative for Creating a Telemedicine Evaluation Framework. *The Telemedicine Journal* 1995;1:393-397.

78. Institute of Medicine (IOM). Telemedicine: A guide to assessing telecommunications in health care (M.J. Field, Ed.). Washington, DC: National Academy Press 1996.

79. Reardon T. Research findings and strategies for assessing telemedicine costs. *Telemed J E Health* 2005; 11:348-369.

80. Stanberry B. Telemedicine: barriers and opportunities in the 21st century (Internal Medicine in the 21st Century). *J Intern Med* 2000; 247: 615–628.

81. Verschueren L. Eliminating Barriers to Healthcare through Telemedicine. *Council of Community Clinics* 2006 (Accessed March 10, 2007).

82. Sjogren LH, Tornqvist H, Schwieler A, Karlsson L. The potential of telemedicine: barriers, incentives and possibilities in the implementation phase. *J Telemed Telecare* 2001; 7:12-13.

83. Whitten P, Franken EA. Telemedicine for patient consultation: factors affecting use by rural primary-care physicians in Kansas. *J Telemed Telecare* 1995; 1: 139-144.

84. May CR, Williams TL, Mair FS, Mort MM, Shaw NT, Gask L. Factors influencing the evaluation of telemedicine interventions: preliminary results from a qualitative study of evaluation projects in the UK. *J Telemed Telecare* 2002; 8:65-67.

85. Sheng OL, Hu PJ, Wei C-P and Ma P-C. Organizational management of telemedicine technology : Conquering time and space boundaries in health care services. *IEEE Transactions on Engineering Management* 1999; 46:265-278.

86. Hu PJ, Chau PYK, Liu Sheng OR, Yan Tam K. Examining the Technology Acceptance Model Using Physician acceptance of Telemedicine Technology. *Journal of Management Information Systems* 1999; 16:91- 112.

87. Whitten P and Allen A. Organizational structure in telemedicine programs. *Telemedicine Today* 1996; 4:15-22.

88. Whitten P, and Adams I. Success and failure: A case study of two rural telemedicine projects. *Journal of Telemedicine and Telecare* 2003, 9 (3), 125-129.

89. Fortin JP, Gagnon M-P, Cloutier A and Labbé F. Evaluation of a telemedicine demonstration project in the Magdalene Islands. *Journal of Telemedicine and Telecare* 2003; 9:89-94.

90. Sicotte C, Champagne F, Farand L, Lacroix A, Rousseau L, Ayé M and Reinharz D. *Analyse de l'expérimentation d'un réseau inter-hospitalier de telemedicine* 1999. Research report 99-03. Montreal, GRIS, University of Montreal.

91. Sicotte C, Champagne F, Farand L, Lacroix A, Rousseau L, Ayé M and Reinharz D. *Analyse de l'expérimentation d'un réseau inter-hospitalier de telemedicine* 1999. Research report 99-03. Montreal, GRIS, University of Montreal.

92. Mintzberg H. *The structuring of organizations : A synthesis of the research* 1979. Englewood Cliffs, NJ : Prentice Hall.

93. DiMaggio P and Powell W. The iron cage revisited : Institutionnal isomorphism and collective rationality in organizational fields. *American Sociological Review* 1983; 48:147-160.

94. Kimberly JR and Evanisko MJ. Organizational innovation : The influence of individual, organizational and contextual factors on hospital adoption of technological and administrative innovations. *Academy of Management Journal* 1981;24:689-713.

95. Gagnon M-P., Lamothe L., Fortin J-P., Reinharz D., Godin G., Gagné C., Cloutier A. Telemedicine adoption in hospitals: An organisational perspective. *Journal of Healthcare Organisation Management* 2003.

96. Lapointe L. and Rivard, S. (1999). The implementation of the system of information clinics. *ASAC 99.*

97. Damanpour F. Organizational innovation: a meta-analysis of effects of determinants and moderators. *Academy of Management Journal* 1991, 34 (3), 555-590.

98. The Minnesota Medical Association – Report on Telemedicine, September 1996.

99. Collins K, Walters S, Bowns I. Patient satisfaction with teledermatology: Quantitative and qualitative results from a randomized controlled trial. J Telemed Telecare 2004;10:29-33.

100. The Minnesota Medical Association – Report on Telemedicine, September 1996.

101. Prasad P and Prasad A. The ideology of professionalism and work computerization: An institutionalist study of technological change. *Human Relations* 1994; 47:1433-1458.

102. Whitten, PS, Mair, FS, Haycox A, May, CR, Williams, TL, Hellmich S. Systematic review of cost effectiveness studies of telemedicine interventions. Information in Practice. *BMJ* 2002;324:1434-1437.

103. Agence-France Presse (2005 March 17) India to launch satellite exclusively for telemedicine. Available: http://servesrilanka.blogspot.com/2005/03/india-to-launch-satellite-exclusively.html. Accessed 27 January 2006.

104. Krishnakumar A (2003 January 18–31) Healing by wire. Frontline. Available: http://www.hinduonnet.com/thehindu/thscrip/print.pl?file=20030117007309400.htmanddate=fl2001/andprd=flineand. Accessed 27 January 2006.

105. Rajalakshmi TK (2004 December) India confronts AIDS. Multinational Monitor. Available: http://multinationalmonitor.org/mm2004/122004/front.html. Accessed 26 January 2006

106. Sharma DC (2000) Remote Indian villages to benefit from telemedicine project. Lancet 355: 1529 Available: http://www.thelancet.com/journals/lancet/article/PIIS0140673605745931/fulltext. Accessed 22 June 2005.

107. Rao R (2005 May) Taking health care to rural areas. i4d. Available: http://www.i4donline.net/May05/satellitetech.asp. Accessed 26 January 2006.

108. Ganapathy K, Telemedicine in the Indian context: An overview. Stud Health Technol Inform 104: 178–181.

109. Pal A, Mbarika VW, Cobb-Payton F, Datta P, McCoy S. Telemedicine diffusion in a developing country: The case of India. *IEEE Trans Inf Technol Biomed* 2005;9: 59–65.

110. Sheng OL, Hu PJ, Wei C-P and Ma P-C. Organizational management of telemedicine technology : Conquering time and space boundaries in health care services. *IEEE Transactions on Engineering Management* 1999; 46:265-278.

111. Hu PJ, Chau PYK, Liu Sheng OR, Yan Tam K. Examining the Technology Acceptance Model Using Physician acceptance of Telemedicine Technology. *Journal of Management Information Systems* 1999; 16:91- 112.

112. Whitten P and Allen A. Organizational structure in telemedicine programs. *Telemedicine Today* 1996; 4:15-22.

113. Whitten P, and Adams I. Success and failure: A case study of two rural telemedicine projects. *Journal of Telemedicine and Telecare* 2003, 9 (3), 125-129.

114. Paulich M, Patricia D, Paulich M, Grigsby J. The Influence of Organizational Characteristics on the Use of Interactive Video (IAV) Telemedicine, *Abstr AcademyHealth Meet* 2003; 20: 438.

ANNEXURES

A. Informed Consent Form

Purpose of the Study:
I, Dr. Allen Prabhaker Ugargol, am a MPH (Master of Public Health) Scholar from Achutha Menon Center for Health Science Studies (AMCHSS), Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram. I am conducting a study titled "A Mid-Term Evaluation Of The ISRO - Supported Telemedicine Project In Karnataka Focusing on Physician Utilization Of Telemedicine And the effect of Physician and Telemedicine Center Characteristics in Determining Utilization" as a research dissertation which is part of my MPH course requirements at AMCHSS, SCTIMST, Thiruvananthapuram, India. This study will assess the use of telemedicine at various centers in Karnataka and the physician and center properties that affect the use of telemedicine and any hindrances therein. The benefit of this study would be in providing a better understanding about telemedicine utilization in Karnataka, the patterns of present utilisation, the barriers that exist to utilization and the enabling environments that need to be created for the end users such as physicians, administrators and technical support personnel in order to harness telemedicine technology and improve provision of tele-health consulting to the remote masses who have no nearby access to specialty medical care.

Consent:
I intend to interview you in connection with my study and would need your consent in order to have you to participate in the interview that I will be conducting at your center. I would assure you that all information that you provide will be kept confidential and will be used solely for the purpose of this study. There will be absolutely no mention of your personal information or the center details in the final report. You are free to refuse to answer any question or all the questions and can withdraw from the interview at any moment. I will be able to clarify if you have any queries about the proposed Interview. In case you need any clarifications about my credentials or the study you can also contact the Head of the Institution, Dr. K.R. Thankappan (Head of the Department, Achutha Menon Center for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram - 695011) or the Member-Secretary of the IEC at SCTIMST, Dr. Anoopkumar Thekkuveettil.

Are you willing to participate in the study? : Yes No

As part of the requirement, I would need your signature indicating your willingness to participate.

Signature of the participant:

Name of the participant:

Signature of the interviewer: Date: Time:

B. Interview Schedule – Telemedicine Specialty Center (TSC)

Section 1 – Physician Properties (to the answered by a Specialist Physician at TSC)

SERIAL NUMBER		TM CENTER	

1.1		Personal details of the respondent:			
	1.1.1	Name:			
	1.1.2	Age:			
	1.1.3	Sex:	Male Female	☐ ☐	1 2
	1.1.4	Designation:	Administrator of TSC Head of the Unit Medical Co-ordinator Specialist Physician	☐ ☐ ☐ ☐	1 2 3 4
	1.1.5	Educational qualification: (tick your highest qualification)	MBBS PG Diploma DNB MD MS DM M.Ch MBA MHA Any Other (mention the qualification)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8 9 10
1.2		Awareness regarding uses of telemedicine			
	1.2.1	Which of the following uses of telemedicine are you familiar with? (tick all that apply)	Tele-diagnosis consultations Clinical tele-consultations CME's through telemedicine E-governance meetings Use in emergencies such as disasters and relief work	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	1.2.2	What according to you is the main use of telemedicine? (tick any one)	To provide specialist consultation to patients who are away from the center To connect physicians and facilitate CME and professional discussions The use in e-governance meetings Use in emergencies such as disaster relief work Not Sure	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	1.2.3	Has telemedicine benefited you in any way?	Yes No	☐ ☐	1 2
	1.2.4	If yes, what are benefits of telemedicine to a physician? Can you list any?			1 2
	1.2.5	Does telemedicine save time for the specialist physician?	Yes No Not sure	☐ ☐ ☐	1 2 3
	1.2.6	If yes, how does it save time? (list a few instances)			1 2
	1.2.7	Does telemedicine save travel costs for the specialist physician?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.2.8	If yes, how does it save on travel costs? (list a few instances)			1 2
	1.2.9	Is telemedicine of any use to the patient community?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.2.10	If yes, how does it prove useful for patients? (list a few instances)			1 2
	1.2.11	Does telemedicine save time and travel costs for the patient?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.2.12	If yes, how does it save time? (list instances)			
	1.2.13	Does telemedicine save on travel costs to the patient?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.2.14	If yes, how does it save on time and travel			1

		costs to the patient? (list a few instances)			
1.3		Training			
	1.3.1	What is the level of training that you have obtained in telemedicine consulting procedures?	More than adequate Adequate Less than adequate Untrained	☐ ☐ ☐ ☐	1 2 3 4
	1.3.2	Have you been trained by the telemedicine service provider (TSP) after the installation of the equipment?	Yes No	☐ ☐	1 2
	1.3.3	What was the training period?	Less than 1 day 1 day 2-3 days	☐ ☐ ☐	1 2 3
	1.3.4	Did the training lack in any aspect?	Yes No		1 2
	1.3.5	Have you received further training in telemedicine usage from any other source?	Yes No	☐ ☐	1 2
	1.3.6	Do you need further follow-up training in telemedicine consultations?	Yes No	☐ ☐	1 2
	1.3.7	If yes, why do you require follow-up training in telemedicine usage? (tick all that apply)	To learn about the recent advances in the process To adapt to newer technologies To learn effective methods of consulting Update on standards of care and guidelines	☐ ☐ ☐ ☐	1 2 3 4
	1.3.8	Are your fellow physicians, nurses and paramedical staff adequately trained in telemedicine use?	Yes No	☐ ☐	1 2
1.4		Acceptance of telemedicine as an useful and easy to use tool			
	1.4.1	How do you rate the usefulness of telemedicine in health applications?	Very useful Somewhat useful Not useful	☐ ☐ ☐	1 2 3
	1.4.2	How comfortable are you with using telemedicine for consultations?	Very comfortable Somewhat comfortable Not at all comfortable	☐ ☐ ☐	1 2 3
	1.4.3	Do you think a telemedicine consultation is more feasible than having a patient at the specialty center in person?	Yes No	☐ ☐	1 2
	1.4.4	If yes, why is the telemedicine consultation more feasible than having the patient at the specialty center in person? (tick all that apply)	Because patient's time is saved Because patient's travel cost is saved Because physician's time is saved	☐ ☐ ☐	1 2 3
	1.4.5	How often do you engage in telemedicine consultations?	Everyday 1-2 times a week 1-2 times a month 1-2 times a year	☐ ☐ ☐ ☐	1 2 3 4
	1.4.6	How do you rate the usefulness of telemedicine to patients who consult from the TCC?	Very useful Somewhat useful Not useful Not sure	☐ ☐ ☐ ☐	1 2 3 4
	1.4.7	Which of the following applications of telemedicine are easier to engage in? (tick all that apply)	Tele-diagnosis Tele-consultations CME's E-governance meetings	☐ ☐ ☐ ☐	1 2 3 4
1.5		Willingness to use telemedicine			
	1.5.1	How often do you attend to telemedicine consultation requests from TCCs concerning to your specialty	Most often Often Rarely	☐ ☐ ☐	1 2 3
	1.5.2	How do you manage to make time for tele-consultations when you are seeing patients in person in your department?	Prepare a schedule and work accordingly Keep aside time for tele-consultations Arrange a backup specialist physician to handle patients in person Any other	☐ ☐ ☐ ☐	1 2 3 4
	1.5.3	Has you center organized CME sessions using telemedicine facilities?	Yes No	☐ ☐	1 2
	1.5.4	If yes to the above question, how often does your center organize CME sessions through telemedicine?	1-2 times a week 1-2 times a month 1-2 times a year	☐ ☐ ☐	1 2 3
	1.5.4	In the last month, how many CME sessions	All of them	☐	1

		telecasted from other centers did you attend?	Most of them Very few of them None of them	☐ ☐ ☐	2 3 4
	1.5.5	What other applications of telemedicine have you used? (list them out)			1
1.6		Satisfaction with telemedicine consultations			
	1.6.1	How do you rate the quality of consultation that is possible through telemedicine?	Good Average Poor	☐ ☐ ☐	1 2 3
	1.6.2	Do you feel the patient from a TCC stands to gain from a tele-consultation with your specialist team through telemedicine rather than personally visiting a specialist center?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.6.3	Are you able to diagnose conditions in the patient accurately through teleconsultation of diagnostic values and the physical examination done by the TCC physician?	Yes, very accurately Yes, substantially No, not very accurately	☐ ☐ ☐	1 2 3
	1.6.4	How do you rate the benefit from the conduct of CME's through telemedicine?	Satisfying Somewhat satisfying Not satisfying Have not attended any CME	☐ ☐ ☐ ☐	1 2 3 4
	1.6.5	How do you rate the usefulness of telemedicine while engaging in research or other collaborations with other institutes?	Satisfying Somewhat satisfying Not satisfying Have not used	☐ ☐ ☐ ☐	1 2 3 4
	1.6.6	How do you rate the satisfaction from e-governance meetings conducted through telemedicine?	Satisfying Somewhat satisfying Not satisfying Have not used	☐ ☐ ☐ ☐	1 2 3 4
	1.6.7	How do you rate the satisfaction from the use of telemedicine for disaster management consultations?	Satisfying Somewhat satisfying Not satisfying Have not used	☐ ☐ ☐ ☐	1 2 3 4
1.7		Incentives to use telemedicine			
	1.7.1	Do physicians and other staff need incentives to use telemedicine to a greater extent?	Yes No	☐ ☐	1 2
	1.7.2	Do you have any incentive from the center to engage in telemedicine?	Yes No	☐ ☐	1 2
	1.7.3	If yes, what is the kind of incentive being offered?	Financial incentive Career-growth incentive No incentive	☐ ☐ ☐	1 2 3
	1.7.4	If existent, does the incentive structure make you engage in telemedicine consultations more often?	Yes No	☐ ☐	1 2
	1.7.5	Is the lack of incentive a cause for the low utilization of telemedicine in your center?	Yes No	☐ ☐	1 2
1.8		Relationship with TCC Physicians and other Specialist Physicians			
	1.8.1	Are any of the TCC Physicians your personal acquaintances?	Yes No	☐ ☐	1 2
	1.8.2	How frequently do you tele-consult with TCC physicians you are acquainted with than with others?	More frequently Somewhat frequently No difference	☐ ☐ ☐	1 2 3
	1.8.3	To what extent does familiarity with the TCC physician contribute towards a smoother telemedicine consultation?	To a large extent Not much There is no difference	☐ ☐ ☐	1 2 3
	1.8.4	Has telemedicine help build new acquaintances and professional friendships across different centers?	Yes No	☐ ☐	1 2
1.9		Perceived Need for Telemedicine			
	1.9.1	How often do you attend professional gatherings/CME's/interactive seminars/conferences?	Quite often Often Sometimes Rarely Never	☐ ☐ ☐ ☐ ☐	1 2 3 4 5

	1.9.2	What are the factors that prevent you from attending professional gatherings/CME's/interactive seminars/conferences frequently? (tick all that apply)	Distance from the venue Travel requirements Time constraints Cost of attendance Work overload Other responsibilities	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6
	1.9.3	Can telemedicine-through professional gatherings/CME's/Interactive seminars/conferences replace the need to travel and attend these events?	Yes, to a large extent Not very much Maybe They cannot be replaced by telemedicine	☐ ☐ ☐ ☐	1 2 3 4
	1.9.5	Do you feel the use of telemedicine has been proportionate to its usefulness?	The use is less and more can be done using telemedicine The use is enough and proportionate to its usefulness The use is high but the usefulness is debatable	☐ ☐ ☐	1 2 3
		Thanking you for your patience			
		Signature of respondent:			
		Date:	Place:		

Interview Schedule – Telemedicine Specialty Center (TSC)
Section 2 – Technical Properties
(to be answered by the Technical Support Person/Administrator)

SERIAL NUMBER			TM CENTER		
2.1		Personal details of the respondent:			
	2.1.1	Name:			
	2.1.2	Age:			
	2.1.3	Sex:	Male Female	☐ ☐	1 2
	2.1.4	Designation:	Administrator of TSC Head of the Unit Medical Co-ordinator Specialist Physician Technical Support Person	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
		Educational qualification: (tick your highest qualification)	M.Sc M.E B.E. B.Sc Other Degree Diploma Certificate Course MBA MHA Any Other	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8 9 10
2.2		Telemedicine room			
	2.2.1	Do you have a designated telemedicine room for consultations?	Yes No	☐ ☐	1 2
	2.2.2	What is the size of your telemedicine consultation room?	12' x 20' 15' x 30' Any other	☐ ☐ ☐	1 2 3
	2.2.3	Which of the following applications are possible in your telemedicine room (tick all that apply)	Telemedicine consultations Tele-diagnosis CME's Inter-professional discussions E-health governance Any other use (mention)	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6
	2.2.4	Which of the following features do you think are available in your telemedicine room? (tick all that you feel are available)	Relevant equipment and connections Power backup Size and space Room temperature control Acoustics Desired type of flooring	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6

			Required Illumination Appropriate colour of the room	☐ ☐	7 8
	2.2.5	Is your telemedicine room equipped based on any guidelines?	Yes No	☐ ☐	1 2
	2.2.6	If yes, which guidelines?			1
	2.2.7	What is the normal duration of operation your telemedicine room?	8 hours daytime More than 8 hours daytime Round the clock (24 hours)	☐ ☐ ☐	1 2 3
2.3		Telemedicine devices and diagnostic equipment			
	2.3.1	Have you had problems with telemedicine devices and diagnostic equipment in the past month?	Yes No	☐ ☐	1 2
	2.3.2	How often have you had problems with the information technology (IT) hardware in your center?	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.3.3	How often have you had problems with connectivity hardware?	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.3.4	How often have you had problems with video conferencing hardware?	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.3.5	How often have you had a problem with essential medical diagnostic hardware?	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.3.6	What is the approximate downtime caused by these equipment problems to the center?	1-2 days 1 week More than a week	☐ ☐ ☐	1 2 3
	2.3.7	How long does it take for service maintenance or repair teams to reach the center?	Same day 1-2 days 1 week More than a week	☐ ☐ ☐ ☐	1 2 3 4
	2.3.8	Who is your equipment service provider?			1
2.4		Connectivity			
	2.4.1	What is the type of connection that your TSC uses?	ISDN Broadband VSAT	☐ ☐ ☐	1 2 3
	2.4.2	Have you had problems in getting connected in the last month?	Yes No	☐ ☐	1 2
	2.4.3	If yes, have these problems with connectivity occurred	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.4.4	Whom do you contact when you are not getting connected?	Telemedicine Service Provider ISRO Any Other agency	☐ ☐ ☐	1 2 3
	2.4.5	Do you get immediate assistance from the telemedicine connection provider?	Yes No	☐ ☐	1 2
2.5		Quality of images and speed of transmission			
	2.5.1	Have you had any problems with the quality of images, eg. Resolution in the last month?	Yes No	☐ ☐	1 2
	2.5.2	If yes, what are the problems? (list them out)			1
	2.5.3	Do these problems in data quality occur	Every time 1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐ ☐	1 2 3 4
	2.5.4	Have you had any problems with the speed of transmission?	Yes No	☐ ☐	1 2
	2.5.5	If yes, what are the problems? (list them out)			1
	2.5.6	Do these problems in speed of transmission occur	Every time 1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐ ☐	1 2 3 4
	2.5.7	Does poor quality of images and reduced speed of transmission hamper your consultation process?	Yes No	☐ ☐	1 2
2.6		Service and maintenance			
	2.6.1	Do you have an annual maintenance contract with a service agency for service and maintenance?	Yes No	☐ ☐	1 2
	2.6.2	If yes, what is the average time taken by the service agency to report to the center and inspect the	Same day 1-2 days	☐ ☐	1 2

		problem?	Within 1 week More than a week	☐ ☐	3 4
	2.6.3	What is the average downtime your center faces when equipment failures occur?	1-2 days Less than a week More than a week	☐ ☐ ☐	1 2 3
	2.6.4	What do you do when there are minor equipment breakdowns?	Report and wait for the service agency Try setting it right yourself Seek other assistance	☐ ☐ ☐	1 2 3
	2.6.5	How adequately are you trained to handle minor equipment breakdowns in the center?	Adequately trained Somewhat trained Not trained	☐ ☐ ☐	1 2 3
	2.6.6	How do you ensure that equipment breakdowns are reduced to a large extent? (tick all that apply)	Using equipment with care Regular service and maintenance Immediate correction of minor problems	☐ ☐ ☐	1 2 3
	2.6.7	How do you rate your center in terms of service and maintenance capability and preparedness?	Well serviced and maintained Moderately serviced and maintained Not very well serviced and maintained	☐ ☐ ☐	1 2 3
		Thank you for your patience	Place:		
		Signature of the respondent	Date:		

Interview Schedule – Telemedicine Specialty Center (TSC)
Section 3 – Administrative Properties
(to be answered by the Administrator/Head of the Unit/Medical Co-ordinator)

SERIAL NUMBER			TM CENTER		
3.1		Personal details of the respondent:			
	3.1.1	Name:			
	3.1.2	Age:			
	3.1.3	Sex:	Male Female	☐ ☐	1 2
	3.1.4	Designation:	Administrator of TSC Head of the Unit Medical Co-ordinator Specialist Physician Technical Support Person	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
		Educational qualification: (tick your highest qualification)	MBBS PG Diploma DNB MD MS DM M.Ch MBA MHA Any Other	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8 9 10
3.2		Willingness to use telemedicine:			
	3.2.1	How frequently does your center engage in telemedicine consultations?	Daily 1-2 times a week Many times a week Few times a month	☐ ☐ ☐ ☐	1 2 3 4
	3.2.2	What is the most common type of consultation your center engages in? (tick one)	TCC requests for patient consultation Tele-diagnosis requests CME telecasts Conducting own CME's Professional discussions E-governance meetings	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6
	3.2.3	How do you record and inform personnel regarding consultation schedules and appointments? (tick all that apply)	Maintain a log book Convey orally Use other communication devices	☐ ☐ ☐	1 2 3
	3.2.4	What is the time taken to respond to a consultation request from a TCC?	Immediately Within 30 minutes More than 30 minutes	☐ ☐ ☐	1 2 3
	3.2.5	How do you ensure adequate utilization of telemedicine facilities?	Set targets for use Encourage personnel to use Monitor use and recommend at times	☐ ☐ ☐	1 2 3
	3.2.6	Have you used any method to encourage the use of telemedicine by your personnel?	Yes No	☐ ☐	1 2
	3.2.7	If yes, mention what method you have used			1

	3.2.8	Which of the following, according to you, is the best way to encourage personnel to use telemedicine?	Motivation Repeated re-enforcing Setting targets Proving incentives Questioning/penalizing	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
3.3		Staffing			
	3.3.1	What is your staff profile in terms of numbers of each type?	Specialist Physicians Nurses Para-medical staff Medical Coordinators Technical Support Personnel	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	3.3.2	What is the required number of staff in order to cater to telemedicine applications?	Specialist Physicians Nurses Para-medical staff Medical Coordinators Technical Support Personnel	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	3.3.3	Do you maintain the same staff strength throughout the year?	Yes No	☐ ☐	1 2
	3.3.4	What are the problems faced by you in maintaining the required number of staff? (tick all that apply)	Difficulty in obtaining trained staff Difficulty in retaining trained staff Inability to recruit more staff due to financial restrictions	☐ ☐ ☐	1 2 3
	3.3.5	What are the common staffing problems that you face at your center that lead to less than optimal usage of telemedicine applications? (tick all that apply)	Absenteeism of workers Unfilled staff positions Non-scheduling of consultation Lack of time Busy with other responsibilities Lack of initiative among staff Lack of financial incentives Any other (name the problem)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8
	3.3.6	How do you see to it that staffing problems do not affect telemedicine activities?			1
3.4		Training of staff			
	3.4.1	How do you rate the overall level of training of your staff?	Adequate Less than Adequate Poor	☐ ☐ ☐	1 2 3
	3.4.2	What proportion of your staff has received post-implementation training from the TSP?	All of them Most of them Few of them None of them	☐ ☐ ☐ ☐	1 2 3 4
	3.4.3	Which category of staff has had the maximum amount of training in the post-implementation phase? (tick one)	Specialist physician Nurses Para-medical Staff Medical Co-ordinator Administrator Technical Support Personnel	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6
	3.4.4	Did your TSC staff carry out dry runs using test and non-patient data?	Yes No	☐ ☐	1 2
	3.4.5	Do you feel your staff needs further follow-up training in telemedicine consultations?	Yes No	☐ ☐	1 2
	3.4.6	If yes, how often have you organized follow-up training for your staff?	Once in 3 months Once in 6 months Once a year	☐ ☐ ☐	1 2 3
	3.4.7	How do you ensure that staff at your center are trained in the use of telemedicine applications? (tick most appropriate one)	Recruit trained staff Schedule follow-up training for staff Encourage staff to undergo training Ensure trained staff are retained	☐ ☐ ☐ ☐	1 2 3 4
3.5		Costs, funding and self sustenance			
	3.5.1	Is your TSC financially self-sufficient to cover operational costs of telemedicine?	Yes No	☐ ☐	1 2
	3.5.2	What is the proportion of your telemedicine expenditure covered by any of these sources? (mention in percentages)	Governmental support Funded by the parent institution Support from other agencies Charging consulting centers Charging patients Any other source		1 2 3 4 5 6
	3.5.3	In what proportion are the following costs being			

		met by your own institution			
	(a)	Administrative staff salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(b)	Physician salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(c)	Nursing and paramedical staff salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(d)	Technical support team salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(e)	Medical co-ordinator salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(f)	Rent for the premises	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(g)	Office equipment (computers, furniture, etc.)	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(h)	Stationery, fax, other office supplies	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(i)	Miscellaneous telemedicine supplies	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(j)	Telemedicine connectivity costs	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(k)	Telemedicine equipment and diagnostic devices	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(l)	Equipment maintenance costs	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	3.5.4	Are you facing any problem with managing the costs of telemedicine usage?	Yes, find it difficult to manage costs A Slight inconvenience No, do not find it difficult at all	☐ ☐ ☐	1 2 3
	3.5.5	What are the plans for sustaining the TSC if the governmental/other agency assistance is withdrawn? (click all that apply)	Own institution funding Institution of user charges Seeking external support Any other plans	☐ ☐ ☐ ☐	1 2 3 4
3.6		Safety, security and confidentiality of patient records			
	3.6.1	Who maintains the patient record databases regularly at your center?	Technical support personnel Administrator Physician Nobody	☐ ☐ ☐ ☐	1 2 3 4
	3.6.2	Have you had any case of breach of safety, security and confidentiality of patient records in your center?	Yes No	☐ ☐	1 2
	3.6.3	Do you follow any guidelines for maintaining safety, security and confidentiality of patient records?	Yes No	☐ ☐	1 2
	3.6.4	If yes, mention which guidelines?			1
	3.6.5	How are the patient record databases kept safe, secure and confidential in your center? (tick what you use)	The databases are password-protected A designated person monitors this aspect routinely Any other (mention) Not monitored thus far	☐ ☐ ☐ ☐	1 2 3 4
	3.6.6	Do you upload patient records to other referral centers where the patient might be referred?	Yes No	☐ ☐	1 2
		Thanking you for your patience			
		Signature of the respondent:			
		Date:	Place:		

C. Interview Schedule– Telemedicine Consulting Center (TCC)

Section 1 – Physician Properties

(to the answered by the Consulting Physician at TCC)

SERIAL NUMBER		TM CENTER	

1.1		Personal details of the respondent:			
	1.1.1	Name:			
	1.1.2	Age:			
	1.1.3	Sex:	Male Female	☐ ☐	1 2
	1.1.4	Designation:	Administrator of TSC Head of the Unit Medical Co-ordinator Specialist Physician	☐ ☐ ☐ ☐	1 2 3 4
	1.1.5	Educational qualification: (tick your highest qualification)	MBBS PG Diploma DNB MD MS DM M.Ch MBA MHA Any Other (mention the qualification)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8 9 10
1.2		Awareness regarding uses of telemedicine			
	1.2.1	Which of the following uses of telemedicine are you familiar with? (tick all that apply)	Tele-diagnosis consultations Clinical tele-consultations CME's through telemedicine E-governance meetings Use in emergencies such as disasters and relief work	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	1.2.2	What according to you is the main use of telemedicine? (tick any one)	To provide specialist consultation to patients who are away from the center To connect physicians and facilitate CME and professional discussions The use in e-governance meetings Use of telemedicine in emergencies such as disaster relief work	☐ ☐ ☐ ☐	1 2 3 4
	1.2.3	Has telemedicine benefited you in any way?	Yes No	☐ ☐	1 2
	1.2.4	If yes, what are benefits of telemedicine to a physician? Can you list any?			1 2
	1.2.5	Does telemedicine save time for you as a physician?	Yes No Not sure	☐ ☐ ☐	1 2 3
	1.2.6	If yes, how does it save time? (list a few instances)			1 2
	1.2.7	Does telemedicine save travel costs for you as a physician?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.2.8	If yes, how does it save on travel costs? list			1
	1.2.9	Is telemedicine of any use to the patient community?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.2.10	If yes, how does it prove useful for patients? (list a few instances)			1 2
	1.2.11	Does telemedicine save time and travel costs for the patient?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.2.12	If yes, how does it save time? (list instances)			1 2
	1.2.13	Does telemedicine save on travel costs to the patient?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.2.14	If yes, how does it save on time and travel costs to the patient? (list a few instances)			1

1.3		Training			
	1.3.1	What is the level of training that you have obtained in telemedicine consulting procedures?	More than adequate Adequate Less than adequate Untrained	☐ ☐ ☐ ☐	1 2 3 4
	1.3.2	Have you been trained by the telemedicine service provider (TSP) after the installation of the equipment?	Yes No	☐ ☐	1 2
	1.3.3	What was the training period?	Less than 1 day 1 day 2-3 days	☐ ☐ ☐	1 2 3
	1.3.4	Did the training lack in any aspect?	Yes No		1 2
	1.3.5	Have you received further training in telemedicine usage from any other source?	Yes No	☐ ☐	1 2
	1.3.6	Do you need further follow-up training in telemedicine consultations?	Yes No	☐ ☐	1 2
	1.3.7	If yes, why do you require follow-up training in telemedicine usage? (tick all that apply)	To learn about the recent advances in the process To adapt to newer technologies To learn effective methods of consulting Update on standards of care and guidelines	☐ ☐ ☐ ☐	1 2 3 4
	1.3.8	Are your fellow physicians, nurses and paramedical staff adequately trained in telemedicine use?	Yes No	☐ ☐	1 2
1.4		Acceptance of telemedicine as an useful and easy to use tool			
	1.4.1	How do you rate the usefulness of telemedicine in health applications?	Very useful Somewhat useful Not useful	☐ ☐ ☐	1 2 3
	1.4.2	How comfortable are you with using telemedicine for consultations?	Very comfortable Somewhat comfortable Not at all comfortable	☐ ☐ ☐	1 2 3
	1.4.3	Do you think a telemedicine consultation is more feasible than having a patient at the specialty center in person?	Yes No	☐ ☐	1 2
	1.4.4	If yes, why is the telemedicine consultation more feasible than having the patient at the specialty center in person? (tick all that apply)	Because patient's time is saved Because patient's travel cost is saved Because physician's time is saved	☐ ☐ ☐	1 2 3
	1.4.5	How often do you engage in telemedicine consultations?	Everyday 1-2 times a week 1-2 times a month 1-2 times a year	☐ ☐ ☐ ☐	1 2 3 4
	1.4.6	How do you rate the usefulness of telemedicine to patients who consult from the TCC?	Very useful Somewhat useful Not useful	☐ ☐ ☐	1 2 3
	1.4.7	Which of the following applications of telemedicine are easier to participate in? (tick all that apply)	Tele-diagnosis Tele-consultations CME's E-governance meetings	☐ ☐ ☐ ☐	1 2 3 4
1.5		Willingness to use telemedicine			
	1.5.1	How often do you consult with TSC physicians for patients who need specialist consultation	Every time Sometimes Rarely	☐ ☐ ☐	1 2 3
	1.5.2	How do you manage to make time for tele-consultations when you are seeing patients in person in your clinic?	Prepare a schedule and work accordingly Keep aside time for tele-consultations Arrange a backup physician to handle patients in person	☐ ☐ ☐	1 2 3
	1.5.3	Do you organize CME sessions from your center?	Yes, often Yes, sometimes Yes, rarely No, never	☐ ☐ ☐ ☐	1 2 3 4
	1.5.4	How often have you requested any TSC to conduct a CME on a topic of interest to you?	Often Sometimes Rarely Never	☐ ☐ ☐ ☐	1 2 3 4
	1.5.5	How many CME sessions telecasted from	All of them	☐	1

		other centers have you attended in the last month?	Most of them Few of them None of them	☐ ☐ ☐	2 3 4
	1.5.6	What other applications of telemedicine have you used? (list them out)			1
1.6		Patient needs			
	1.6.1	How often do you consult with TSCs through telemedicine for patient needs?	Very often Often Sometimes Rarely Never	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	1.6.2	How many tele-consultations did you engage in to cater to patient needs at your TCC in the last month?			
	1.6.3	What is the most common reason for consulting the TSC: (tick the most common reason)	When patient cannot be managed without specialist consultation When it is not feasible to refer the patient to a specialty center To consult regarding a rare disorder or condition To improve your knowledge and understanding When patient asks for a specialist consultation	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	1.6.4	How many tele-diagnosis consultations did you engage in to cater to patient needs in the last month?			1
	1.6.5	Did any patients request you to consult with specialist physicians in the last month?	Yes No	☐ ☐	1 2
	1.6.6	Did any patient refuse participating in a teleconsultation with a specialist physician?	Yes No	☐ ☐	1 2
	1.6.7	Who informs the patient about the need for a consultation, what to expect during a tele-consultation and the general procedure that follows?			1
	1.6.8	How do you obtain patient willingness to the tele-consultation?			1
1.7		Satisfaction with telemedicine consultations			
	1.7.1	How do you rate the quality of consultation that is possible through telemedicine?	Good Average Poor	☐ ☐ ☐	1 2 3
	1.7.2	Do you feel the patient from a TCC stands to gain from a tele-consultation with the TSC specialist team through telemedicine rather than personally visiting a specialist center?	Yes No Not Sure	☐ ☐ ☐	1 2 3
	1.7.3	Do you think the TSC physicians are able to diagnose conditions in the patient accurately through teleconsultation of diagnostic values and the physical examination done by the TCC physician?	Yes, very accurately Yes, substantially No, not very accurately	☐ ☐ ☐	1 2 3
	1.7.4	How do you rate the benefit from the conduct of CME's through telemedicine?	Satisfying Somewhat satisfying Not satisfying Have not attended any CME	☐ ☐ ☐ ☐	1 2 3 4
	1.7.5	How do you rate the usefulness of telemedicine while engaging in research or other collaborations with other institutes?	Satisfying Somewhat satisfying Not satisfying Have not used	☐ ☐ ☐ ☐	1 2 3 4
	1.7.6	How do you rate the satisfaction from e-governance meetings conducted through telemedicine?	Satisfying Somewhat satisfying Not satisfying Have not used	☐ ☐ ☐ ☐	1 2 3 4
	1.7.7	How do you rate the satisfaction from the use of telemedicine for disaster management consultations?	Satisfying Somewhat satisfying Not satisfying Have not used	☐ ☐ ☐ ☐	1 2 3 4
1.8		Incentives to use telemedicine			
	1.8.1	Do physicians and other staff need incentives to use telemedicine to a greater extent?	Yes No	☐ ☐	1 2
	1.8.2	Do you have any incentive from the center to	Yes	☐	1

		engage in telemedicine?	No	☐	2
	1.8.3	If yes, what is the kind of incentive being offered?	Financial incentive Career-growth incentive No incentive	☐ ☐ ☐	1 2 3
	1.8.4	Does the incentive structure make you engage in telemedicine consultations more often?	Yes No	☐ ☐	1 2
1.9		Relationship with TSC Physicians and other Specialist Physicians			
	1.9.1	Are any of the TSC Physicians your personal acquaintances?	Yes No	☐ ☐	1 2
	1.9.2	How frequently do you tele-consult with TSC physicians you are acquainted with than with others?	Very frequently Somewhat frequently No difference	☐ ☐ ☐	1 2 3
	1.9.3	To what extent does familiarity with the TSC physician contribute towards a smoother telemedicine consultation?	To a large extent Not much There is no difference	☐ ☐ ☐	1 2 3
	1.9.4	Has telemedicine help build new acquaintances and professional friendships across different centers?	Yes No	☐ ☐	1 2
1.10		Perceived Need for Telemedicine			
	1.10.1	How often do you attend professional gatherings/CME's/interactive seminars/conferences?	Quite often Often Sometimes Rarely Never	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	1.10.2	What are the factors that prevent you from attending professional gatherings/CME's/interactive seminars/conferences frequently? (tick all that apply)	Distance from the venue Travel requirements Time constraints Cost of attendance Work overload Other responsibilities	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6
	1.10.3	Can telemedicine-through professional gatherings/CME's/Interactive seminars/conferences replace the need to travel and attend these events?	Yes, to a large extent Not very much Maybe They cannot be replaced by telemedicine	☐ ☐ ☐ ☐	1 2 3 4
	1.10.4	Do you feel the use of telemedicine has been proportionate to its usefulness?	The use is less and more can be done using telemedicine The use is enough and proportionate to its usefulness The use is high but the usefulness is debatable.	☐ ☐ ☐	1 2 3
		Thanking You for your Patience	Place:		
		Signature of the Respondent:	Date:		

Interview Schedule– Telemedicine Consulting Center (TCC) Section 2 – Technical Properties

(to the answered by the Technical Support Person/Administrator)

SERIAL NUMBER			TM CENTER		
2.1		Personal details of the respondent:			
	2.1.1	Name:			
	2.1.2	Age:			
	2.1.3	Sex:	Male Female	☐ ☐	1 2
	2.1.4	Designation:	Administrator of TSC Head of the Unit Medical Co-ordinator Specialist Physician Technical Support Person	☐ ☐ ☐ ☐ ☐	1 2 3 4 5

		Educational qualification: (tick your highest qualification)	M.Sc M.E B.E. B.Sc Other Degree Diploma Certificate Course MBA MHA Any Other (mention the qualification)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8 9 10
2.2		Telemedicine room			
	2.2.1	Do you have a designated telemedicine room for consultations?	Yes No	☐ ☐	1 2
	2.2.2	What is the size of your telemedicine consultation room?	12' x 20' 15' x 30' Any other	☐ ☐ ☐	1 2 3
	2.2.3	Which of the following applications are possible in your telemedicine room (tick all that apply)	Telemedicine consultations Tele-diagnosis CME's Inter-professional discussions E-health governance Any other use (mention)	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6
	2.2.4	Which of the following features do you think are available in your telemedicine room? (tick all that you feel are available)	Relevant equipment and connections Power backup Size and space Room temperature control Acoustics Desired type of flooring Required Illumination Appropriate colour of the room	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8
	2.2.5	Is you telemedicine room equipped based on any guidelines?	Yes No	☐ ☐	1 2
	2.2.6	If yes, which guidelines?			1
	2.2.7	What is the normal duration of operation your telemedicine room?	8 hours daytime More than 8 hours daytime Round the clock (24 hours)	☐ ☐ ☐	1 2 3
2.3		Telemedicine devices and diagnostic equipment			
	2.3.1	Have you had problems with telemedicine devices and diagnostic equipment in the past month?	Yes No	☐ ☐	1 2
	2.3.2	How often have you had problems with the information technology (IT) hardware in your center?	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.3.3	How often have you had problems with connectivity hardware?	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.3.4	How often have you had problems with video conferencing hardware?	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.3.5	How often have you had a problem with essential medical diagnostic hardware?	1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐	1 2 3
	2.3.6	What is the approximate downtime caused by these equipment problems to the center?	1-2 days 1 week More than a week	☐ ☐ ☐	1 2 3
	2.3.7	How long does it take for service maintenance or repair teams to reach the center?	Same day 1-2 days 1 week More than a week	☐ ☐ ☐ ☐	1 2 3 4
	2.3.8	Who is your equipment service provider?			1
2.4		Connectivity			
	2.4.1	What is the type of connection that your TCC uses?	ISDN Broadband VSAT	☐ ☐ ☐	1 2 3
	2.4.2	Have you had problems in getting connected in the last month?	Yes No	☐ ☐	1 2
	2.4.3	If yes, have these problems with connectivity	1-2 times / 5 consultations	☐	1

		occurred	1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐	2 3
	2.4.4	Whom do you contact when you are not getting connected?	Telemedicine Service Provider ISRO Any Other agency	☐ ☐ ☐	1 2 3
	2.4.5	Do you get immediate assistance from the telemedicine connection provider?	Yes No	☐ ☐	1 2
2.5		Quality of images and speed of transmission			
	2.5.1	Have you had any problems with the quality of images, eg. Resolution in the last month?	Yes No	☐ ☐	1 2
	2.5.2	If yes, what are the problems? (list them out)			1
	2.5.3	Do these problems in data quality occur	Every time 1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐ ☐	1 2 3 4
	2.5.4	Have you had any problems with the speed of transmission?	Yes No	☐ ☐	1 2
	2.5.5	If yes, what are the problems? (list them out)			1
	2.5.6	Do these problems in speed of transmission occur	Every time 1-2 times / 5 consultations 1-2 times / 10 consultations 1-2 times / 25 consultations	☐ ☐ ☐ ☐	1 2 3 4
	2.5.7	Does poor quality of images and reduced speed of transmission hamper your consultation process?	Yes No	☐ ☐	1 2
2.6		Service and maintenance			
	2.6.1	Do you have an annual maintenance contract with a service agency for service and maintenance?	Yes No	☐ ☐	1 2
	2.6.2	If yes, what is the average time taken by the service agency to report to the center and inspect the problem?	Same day 1-2 days Within 1 week More than a week	☐ ☐ ☐ ☐	1 2 3 4
	2.6.3	What is the average downtime your center faces when equipment failures occur?	1-2 days Less than a week More than a week	☐ ☐ ☐	1 2 3
	2.6.4	What do you do when there are minor equipment breakdowns?	Report and wait for the service agency Try setting it right yourself Seek other assistance	☐ ☐ ☐	1 2 3
	2.6.5	How adequately are you trained to handle minor equipment breakdowns in the center?	Adequately trained Somewhat trained Not trained	☐ ☐ ☐	1 2 3
	2.6.6	How do you ensure that equipment breakdowns are reduced to a large extent? (tick all that apply)	Using equipment with care Regular service and maintenance Immediate correction of minor problems	☐ ☐ ☐	1 2 3
	2.6.7	How do you rate your center in terms of service and maintenance capability and preparedness?	Well serviced and maintained Moderately serviced and maintained Not very well serviced and maintained	☐ ☐ ☐	1 2 3
		Thank you for your patience	Signature of the respondent:		
		Date:	Place:		

Interview Schedule– Telemedicine Consulting Center (TCC)
Section 3 – Administrative Properties
(to be answered by the Administrator/Head of the Unit/Medical Co-ordinator)

SERIAL NUMBER			TM CENTER		
3.1		Personal details of the respondent:			
	3.1.1	Name:			
	3.1.2	Age:			
	3.1.3	Sex:	Male Female	☐ ☐	1 2
	3.1.4	Designation:	Administrator of TSC Head of the Unit Medical Co-ordinator Specialist Physician Technical Support Person	☐ ☐ ☐ ☐ ☐	1 2 3 4 5

		Educational qualification: (tick your highest qualification)	MBBS PG Diploma DNB MD MS DM M.Ch MBA MHA Any Other (mention the qualification)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8 9 10
3.2		Willingness to use telemedicine:			
	3.2.1	How frequently does your center engage in telemedicine consultations?	Daily 1-2 times a week Many times a week Few times a month	☐ ☐ ☐ ☐	1 2 3 4
	3.2.2	What is the most common type of consultation your center engages in? (tick one)	Patient consultations with TSCs Tele-diagnosis consultations with TSC Attending CME telecasts Conducting own CME's Professional discussions E-governance meetings	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6
	3.2.3	How do you record and inform personnel regarding consultation schedules and appointments? (tick all that apply)	Maintain a log book Convey orally Use other communication devices	☐ ☐ ☐	1 2 3
	3.2.4	How do you ensure adequate utilization of telemedicine facilities?	Set targets for use Encourage personnel to use Monitor use and recommend at times	☐ ☐ ☐	1 2 3
	3.2.5	Have you used any method to encourage the use of telemedicine by your personnel?	Yes No	☐ ☐	1 2
	3.2.6	If yes, mention what method did you use			1
	3.2.7	Which of the following, according to you, is the best way to encourage personnel to use telemedicine?	Motivation Repeated re-enforcing Setting targets Proving incentives Questioning/penalizing non-utilization	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
3.3		Staffing			
	3.3.1	What is your staff profile in terms of numbers of each type?	Consulting Physicians Nurses Para-medical staff Medical Coordinators Technical Support Personnel	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	3.3.2	What is the required number of staff in order to cater to telemedicine applications?	Consulting Physicians Nurses Para-medical staff Medical Coordinators Technical Support Personnel	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	3.3.3	Do you maintain the same staff strength throughout the year?	Yes No	☐ ☐	1 2
	3.3.4	What are the problems faced by you in maintaining the required number of staff? (tick all that apply)	Difficulty in obtaining trained staff Difficulty in retaining trained staff Inability to recruit more staff due to financial restrictions	☐ ☐ ☐	1 2 3
	3.3.5	What are the common staffing problems that you face at your center that lead to less than optimal usage of telemedicine applications? (tick all that apply)	Absenteeism of workers Unfilled staff positions Non-scheduling of consultation Lack of time Busy with other responsibilities Lack of initiative among staff Lack of financial incentives Any other (name the problem)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7 8
	3.3.6	How do you ensure that staffing problems do not affect telemedicine activities?			
3.4		Training of staff			
	3.4.1	How do you rate the overall level of training of your staff?	Adequate Less than Adequate Poor	☐ ☐ ☐	1 2 3
	3.4.2	What proportion of your staff has received	All of them	☐	1

		post-implementation training from the TSP?	Most of them Few of them None of them	☐ ☐ ☐	2 3 4
	3.4.3	Which category of staff has had the maximum amount of training in the post-implementation phase? (tick one)	Specialist physician Nurses Para-medical Staff Medical Co-ordinator Administrator Technical Support Personnel	☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6
	3.4.4	Did your TCC staff carry out dry runs using test and non-patient data?	Yes No	☐ ☐	1 2
	3.4.5	Do you feel your staff needs further follow-up training in telemedicine?	Yes No	☐ ☐	1 2
	3.4.6	If yes, how often have you organized follow-up training for your staff?	Once in 3 months Once in 6 months Once a year	☐ ☐ ☐	1 2 3
	3.4.7	How do you ensure that staff at your center are trained in the use of telemedicine applications? (tick most appropriate one)	Recruit trained staff Schedule follow-up training for staff Encourage staff to undergo training Ensure trained staff are retained	☐ ☐ ☐ ☐	1 2 3 4
3.5		Costs, funding and self sustenance			
	3.5.1	Is your TCC financially self-sufficient to cover operational costs of telemedicine?	Yes No	☐ ☐	1 2
	3.5.2	What is the proportion of your telemedicine expenditure covered by any of these sources? (mention in percentages)	Governmental support Funded by the parent institution Support from other agencies Charging patients Any other source	☐ ☐ ☐ ☐ ☐	1 2 3 4 5
	3.5.3	In what proportion are the following costs being met by your own institution			
	(a)	Administrative staff salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(b)	Physician salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(c)	Nursing and paramedical staff salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(d)	Technical support team salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(e)	Medical co-ordinator salaries	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(f)	Rent for the premises	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(g)	Office equipment (computers, furniture, etc.)	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(h)	Stationery, fax, other office supplies	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(i)	Miscellaneous telemedicine supplies	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(j)	Telemedicine connectivity costs	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(k)	Telemedicine equipment and diagnostic devices	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	(l)	Equipment maintenance costs	Fully met Partially met Not met	☐ ☐ ☐	1 2 3
	3.5.4	Are you facing any problem with managing the	Yes, find it difficult to manage costs	☐	1

		costs of telemedicine usage?	A Slight inconvenience No, do not find it difficult at all	☐ ☐	2 3
	3.5.5	What are the plans for sustaining the TCC if the governmental/other agency assistance is withdrawn? (click all that apply)	Own institution funding Institution of user charges Seeking external support Any other plans	☐ ☐ ☐ ☐	1 2 3 4
3.6		Safety, security and confidentiality of patient records			
	3.6.1	Who maintains the patient record databases regularly at your center?	Technical support personnel Administrator Physician Nobody	☐ ☐ ☐ ☐	1 2 3 4
	3.6.2	Have you had any case of breach of safety, security and confidentiality of PIR?	Yes No	☐ ☐	1 2
	3.6.3	Do you follow any guidelines for maintaining safety, security and confidentiality of patient records?	Yes No	☐ ☐	1 2
	3.6.4	If yes, mention which guidelines?			1
	3.6.5	How are the patient record databases kept safe, secure and confidential in your center? (tick what you use)	The databases are password-protected A designated person monitors this Any other (mention) Not monitored thus far	☐ ☐ ☐ ☐	1 2 3 4
	3.6.6	Do you upload patient records to other referral centers where the patient might be referred?	Yes No	☐ ☐	1 2
		Thanking you for your patience			
		Signature of the respondent:			
		Date:	Place:		

D. Facility Checklist

(To Be Completed By The Investigator Based On Tele-Health Log Book, Monthly Network Utilization Records And Administrative Records)

SERIAL NUMBER		TM CENTER			
1.	Identification Of The Telemedicine Node				
		Primary Health Center Community Health Center District Hospital Govt. Specialty Hospital Medical College Hospital NGO Hospital Corporate Hospital	☐ ☐ ☐ ☐ ☐ ☐ ☐	1 2 3 4 5 6 7
2.	Type Of Telemedicine Center	TSC	☐	1
		TCC	☐	2
3.	Status Of The Center	Specialty End	☐	1
		Patient End	☐	2
4.	When Was The Center Begun			
5.	What Is The Approximate Population Served			
6.	Does The Center Maintaining A Tele-Health Log Book	Yes No	☐ ☐	1 2
7.	Is The Center Maintaining Network Utilization Records	Yes No	☐ ☐	1 2
8.	Is The Center Maintaining Administrative Records	Yes No	☐ ☐	1 2
9.	Total Number Of Telemedicine Consultations Handled In The Last Month?			1
	Number Of Activities In The Last Month By Type:			
10.	Tele-Consultations			
11	Tele-Diagnostic Consultations			
12	Tele-Education and Training Consultations			
13	CME Sessions			
14	Research Collaboration Consultations			
15	E-Health Governance Meetings			
16	Disaster Management Consultations			
17	Any Other Type Of Consultation			
18	How Many TSCs Connected with you Last Month?			
19	How Many TCCs Connected with you Last Month?			
	Number of Staff by Type:			
20	Specialist/Consulting Physicians			
21	Nurses At This Center			
22	Paramedical Staff At This Center			
23	Technical Support Personnel At This Center			
24	In The Last Week, How Many Hours Of consultations were recorded?			
25	What Is The Incentive For Staff To Engage In Telemedicine?			
26	There is no Incentive		☐	
27	What Are The Problems/Issues That Are Commonly Entered Into The Tele-Health Log Book?			
28	No problems/issues have been entered into the tele-health log book		☐	
29	What Were The Staff Efforts In The Last Month To Improve Telemedicine Consultations (list any)			
30	No efforts are evident		☐	

Date: Place:

E. TABLES AND CHARTS

TABLE 1 - TCC STAFF CHARACTERISTICS

CHARACTERISTIC	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
TYPE OF STAFF				
Administrator	7	20.6	20.6	20.6
Physician	14	41.2	41.2	61.8
Technician	13	38.2	38.2	100.0
SEX				
Male	29	85.3	85.3	85.3
Female	5	14.7	14.7	100.0
DESIGNATION				
Administrator of TCC	7	20.6	20.6	20.6
Head of the Unit	4	11.8	11.8	32.4
Medical Coordinator	1	2.9	2.9	35.3
Specialist Physician	9	26.5	26.5	61.8
Technical Support Person	13	38.2	38.2	100.0
HIGHEST EDUCATION				
MBBS	4	11.8	11.8	11.8
PG Diploma	6	17.6	17.6	29.4
MD	8	23.5	23.5	52.9
MS	1	2.9	2.9	55.9
MBA	1	2.9	2.9	58.8
BSc	3	8.8	8.8	67.6
Certificate Course	5	14.7	14.7	82.4
Any other Diploma	6	17.6	17.6	100.0

TABLE 2 - TSC Staffing Details

Telemedicine Specialty Centre (TSC)	Number of Specialist Physicians	Number of Nurses	Number of Paramedical Staff	Number of Technical Support Personnel
JSS Medical College Hospital	2	2	1	2
Narayana Hrudayalaya	7	8	2	5
NIMHANS	2	3	1	1
Samatvam Inst. of Diabetology	2	4	1	1
St. John's Medical College	2	3	1	1
Vittala Institute of Opthalmology	5	3	1	2

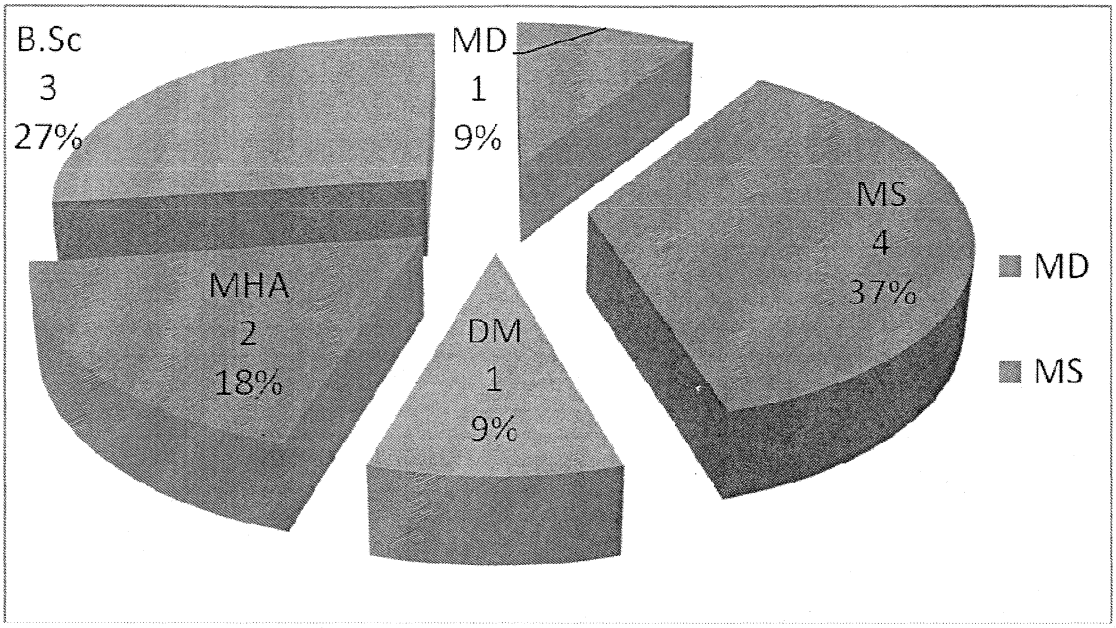


CHART 1 - TSC STAFF PROFILE BY HIGHEST EDUCATION

CHART 2 – TCC STAFF PROFILE BY HIGHEST EDUCATION

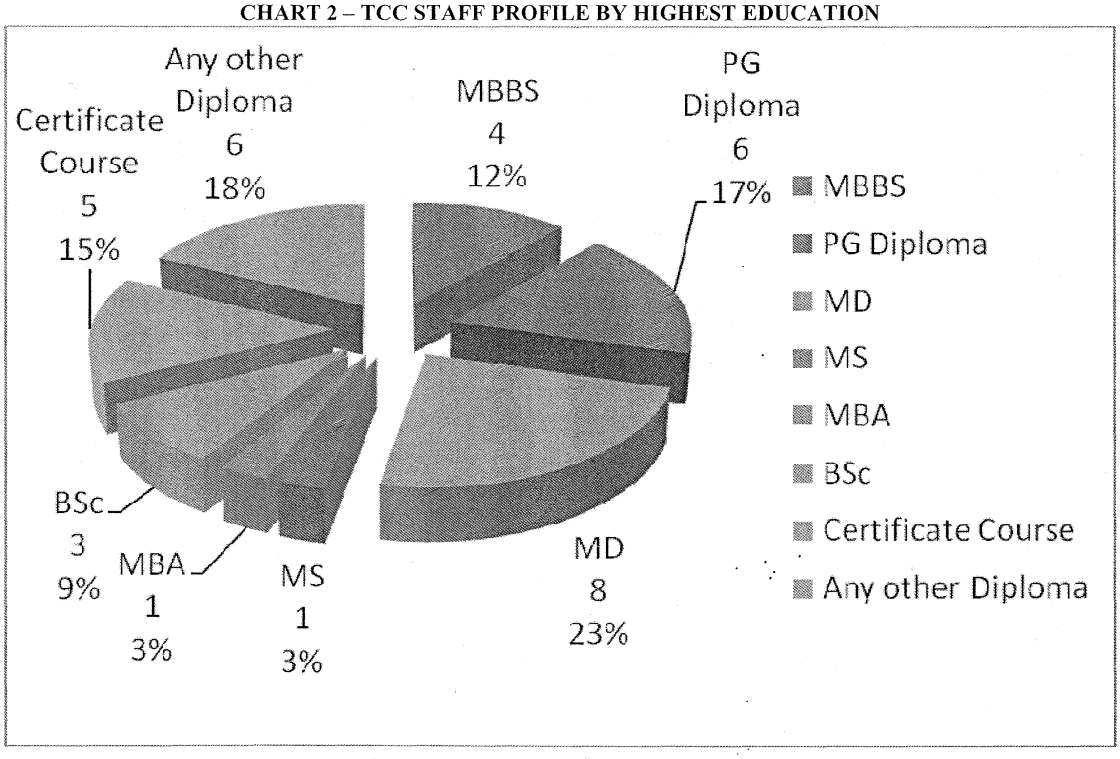


Table 3 - TCC PHYSICIAN CHARACTERISTICS - AWARENESS REGARDING USES OF TELEMEDICINE				
CHARACTERISTIC	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Familiarity with Tele-diagnosis consultations				
Yes	14	100.0	100.0	100.0
Familiar with clinical tele-consultations				
Yes	11	78.6	78.6	78.6
No	3	21.4	21.4	100.0
Familiar with CMEs through telemedicine				
Yes	4	28.6	28.6	28.6
No	10	71.4	71.4	100.0
Familiar with E-governance meetings				
Yes	2	14.3	14.3	14.3
No	12	85.7	85.7	100.0
Familiar with the Use in emergencies such as disasters and relief work				
Yes	2	14.3	14.3	14.3
No	12	85.7	85.7	100.0
Main use of telemedicine				
To provide specialist consultation to patients who are away from the centre	9	64.3	64.3	64.3
To connect physicians and facilitate CME and professional discussions	5	35.7	35.7	100.0
Has telemedicine benefitted you				
Yes	13	92.9	92.9	92.9
No	1	7.1	7.1	100.0
What are the benefits of telemedicine to a physician				
0	8	57.1	57.1	57.1
Difficult cases can be diagnosed and treated	1	7.1	7.1	64.3
Easy Diagnosis and Treatment	1	7.1	7.1	71.4
Expert Opinion	1	7.1	7.1	78.6
Second opinion for complicated cases	1	7.1	7.1	85.7
Second opinion, improve knowledge	1	7.1	7.1	92.9
Teleconsultation increases knowledge	1	7.1	7.1	100.0
Telemedicine saves time for you as a physician?				
Yes	7	50.0	50.0	50.0
Not sure	5	35.7	35.7	85.7
No	2	14.3	14.3	100.0
how does telemedicine save time?				
0	12	85.7	85.7	85.7
Able to diagnose and treat patients from remote areas	1	7.1	7.1	92.9
Provides opinion of cardiologist and other super-specialists in a short span of time	1	7.1	7.1	100.0
Telemedicine save travel costs for you as a physician?				
Yes	10	71.4	71.4	71.4
Not sure	1	7.1	7.1	78.6
No	3	21.4	21.4	100.0
telemedicine saves travel costs?				
0	11	78.6	78.6	78.6
Avoids travel to higher centers	1	7.1	7.1	85.7
Saves travel costs by getting opinion from super-specialists at higher centers	1	7.1	7.1	92.9
Specialists are available immediately	1	7.1	7.1	100.0
Use to the patient community?				
Yes	14	100.0	100.0	100.0
how is it useful for patients				
0	5	35.7	35.7	35.7
Early diagnosis and treatment for patients	3	21.4	21.4	57.1
Specialist consultation is available	1	7.1	7.1	64.3
Time and travel cost is saved	5	35.7	35.7	100.0
Does telemedicine save time and travel costs for the patient?	XXII			
Yes	14	100.0	100.0	100.0
how does it save time for the patient?				

0	9	64.3	64.3	64.3
Avoids the need for appointments	2	14.3	14.3	78.6
Saves travel time to higher centre	3	21.4	21.4	100.0
Does telemedicine save on travel costs to the patient?				
Yes	14	100.0	100.0	100.0
how does it save on time and travel costs to the patient?				
0	9	64.3	64.3	64.3
Avoids travel to tertiary care centre	3	21.4	21.4	85.7
Early diagnosis and prompt initiation of treatment	1	7.1	7.1	92.9
Saves time of travelling and other costs of going to a higher centre.	1	7.1	7.1	100.0

TABLE 4 - TSC PHYSICIAN CHARACTERISTICS –AWARENESS REGARDING THE USES OF TELEMEDICINE

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Familiar with Tele-diagnosis consultations				
Yes	3	100.0	100.0	100.0
Familiar with clinical tele-consultations				
Yes	3	100.0	100.0	100.0
Familiar with CMEs through telemedicine				
Yes	3	100.0	100.0	100.0
Familiar with e-governance meetings				
0	1	33.3	33.3	33.3
Yes	2	66.7	66.7	100.0
Familiar with emergencies such as disasters and relief work				
0	1	33.3	33.3	33.3
Yes	1	33.3	33.3	66.7
No	1	33.3	33.3	100.0
Main use of telemedicine				
To provide specialist consultation to patients who are away from the centre	3	100.0	100.0	100.0
Has telemedicine benefitted you?				
Yes	3	100.0	100.0	100.0
Benefits of telemedicine to a physician				
As an eye surgeon, I can treat remote patients	1	33.3	33.3	33.3
Can treat many patients at once and saves time	1	33.3	33.3	66.7
Patients in remote areas can save time & money	1	33.3	33.3	100.0
Telemedicine saves time for the specialist physician?				
Not sure	1	33.3	33.3	33.3
Yes	2	66.7	66.7	100.0
How does telemedicine save time				
Follow-up can be done easily	1	33.3	33.3	33.3
Many patients can be consulted in a given slot	1	33.3	33.3	66.7
Prompt and quick consultation, periodic monitoring	1	33.3	33.3	100.0
Telemedicine save travel costs for the specialist physician?				
Yes	3	100.0	100.0	100.0
How does telemedicine save on travel costs				
Avoids travel for follow-up	1	33.3	33.3	33.3
For follow-ups, no need to travel	1	33.3	33.3	66.7
No need to travel to see patient	1	33.3	33.3	100.0
Telemedicine useful to patient community?				
Yes	3	100.0	100.0	100.0
How does it prove useful for patients?				
Prompt & economical	1	33.3	33.3	33.3
Provides experts	1	33.3	33.3	66.7
Specialist sees them	1	33.3	33.3	100.0
Does telemedicine save time and travel costs for the patient?				
Yes	3	100.0	100.0	100.0
How does it save time?				
Immediate consultation	1	33.3	33.3	33.3

No need to travel	1	33.3	33.3	66.7
No waiting queues	1	33.3	33.3	100.0
Does telemedicine save on travel costs to the patient?				
3	3	100.0	100.0	100.0
How does it save on time and travel costs to the patient?				
No need to travel	1	33.3	33.3	33.3
No travel time wastage	1	33.3	33.3	66.7
Travel cost is avoided	1	33.3	33.3	100.0

TABLE 5 - TCC PHYSICIAN - ACCEPTANCE OF TELEMEDICINE AS AN USEFUL AND EASY TO USE TOOL

CHARATERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Rate the usefulness of telemedicine in health applications?				
Somewhat useful	9	64.3	64.3	64.3
Very useful	5	35.7	35.7	100.0
Comfort with using telemedicine for consultations?				
Somewhat comfortable	10	71.4	71.4	71.4
Very comfortable	4	28.6	28.6	100.0
Telemedicine consultation is more feasible than having a patient at the specialty centre in person?				
Yes	11	78.6	78.6	78.6
No	3	21.4	21.4	100.0
Telemedicine consultation is feasible because patient's time is saved				
Yes	8	57.1	57.1	57.1
No	6	42.9	42.9	100.0
Telemedicine consultation is feasible because patient's travel cost is saved				
Yes	10	71.4	71.4	71.4
No	4	28.6	28.6	100.0
Telemedicine consultation is feasible because physician's time is saved(				
Yes	4	28.6	28.6	28.6
No	10	71.4	71.4	100.0
Frequency of engaging in telemedicine consultations?				
1-2 times a year	1	7.1	7.1	7.1
1-2 times a month	8	57.1	57.1	64.3
1-2 times a week	1	7.1	7.1	71.4
Everyday	4	28.6	28.6	100.0
How do you rate the usefulness of telemedicine to patients?				
Somewhat useful	9	64.3	64.3	64.3
Very useful	5	35.7	35.7	100.0
Tele-diagnosis is easier to participate in				
Yes	11	78.6	78.6	78.6
No	3	21.4	21.4	100.0
Tele-diagnosis is easier to participate in				
Yes	12	85.7	85.7	85.7
No	2	14.3	14.3	100.0
CMEs are easy to participate in				
Yes	3	21.4	21.4	21.4
No	11	78.6	78.6	100.0
E-governance meetings are easy to participate in				
Yes	3	21.4	21.4	21.4
No	11	78.6	78.6	100.0

TABLE 6 - TSC PHYSICIAN CHARACTERISTICS – ACCEPTANCE OF TELEMEDICINE AS AN USEFUL AND EASY TO USE TOOL

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Rate the usefulness of telemedicine in health applications?				

Very useful	3	100.0	100.0	100.0
How comfortable are you with using telemedicine for consultations?				
Somewhat comfortable	1	33.3	33.3	33.3
Very comfortable	2	66.7	66.7	100.0
Is a telemedicine consultation more feasible than sending a patient to the specialty centre in person?				
Yes	3	100.0	100.0	100.0
Telemedicine consultation is more feasible than having the patient at the specialty centre in person because patient's time is saved				
Yes	3	100.0	100.0	100.0
Telemedicine consultation is more feasible than having the patient at the specialty centre in person because patient's travel cost is saved				
Yes	3	100.0	100.0	100.0
Telemedicine consultation is more feasible than having the patient at the specialty centre in person because physician's time is saved				
Yes	3	100.0	100.0	100.0
Frequency of engaging in telemedicine consultations?				
1-2 times a month	2	66.7	66.7	66.7
Everyday	1	33.3	33.3	100.0
Rate the usefulness of telemedicine to patients who consult from the TCC?				
Very useful	3	100.0	100.0	100.0
It is easier to engage in Tele-diagnosis				
Yes	3	100.0	100.0	100.0
It is easier to engage in tele-consultations				
Yes	3	100.0	100.0	100.0
It is easier to engage in CMEs				
Yes	2	66.7	66.7	66.7
No	1	33.3	33.3	100.0
It is easier to engage in E-governance meetings				
0	2	66.7	66.7	66.7
Yes	1	33.3	33.3	100.0

TABLE 7 - TCC PHYSICIAN CHARACTERISTICS – WILLINGNESS TO USE TELEMEDICINE

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Frequency of consultation with TSC physicians				
Rarely	5	35.7	35.7	35.7
Sometimes	8	57.1	57.1	92.9
Every time	1	7.1	7.1	100.0
How do you make time for tele-consultations when you are seeing patients in person at your clinic?				
Prepare a schedule and work accordingly	6	42.9	42.9	42.9
Keep aside time for tele-consultations	4	28.6	28.6	71.4
Arrange a backup physician to handle patients in person	4	28.6	28.6	100.0
Organize CME sessions from your centre?				
No, never	12	85.7	85.7	85.7
Yes, rarely	1	7.1	7.1	92.9
Yes, often	1	7.1	7.1	100.0
Frequency of requesting a TSC to conduct a CME on a topic of interest to you?				
Never	7	50.0	50.0	50.0
Rarely	2	14.3	14.3	64.3
Sometimes	4	28.6	28.6	92.9
Often	1	7.1	7.1	100.0

TABLE 8 - TSC PHYSICIAN CHARACTERISTICS – WILLINGNESS TO USE TELEMEDICINE

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT

Frequency of attending to telemedicine consultation requests from TCCs				
Often	2	66.7	66.7	66.7
Most often	1	33.3	33.3	100.0
How do you manage to make time for tele-consultations when you are seeing patients in person at your clinic?				
Keep aside time for tele-consultations	1	33.3	33.3	33.3
Arrange a backup specialist physician to handle patients in person	2	66.7	66.7	100.0
Organized CME sessions through telemedicine				
Yes	1	33.3	33.3	33.3
No	2	66.7	66.7	100.0
Frequency of organizing CME sessions through telemedicine?				
0	2	66.7	66.7	66.7
1-2 times a week	1	33.3	33.3	100.0
Number of CME sessions that were telecasted from other centers attended				
Most of them	3	100.0	100.0	100.0
Other applications of telemedicine used				
mobile telemedicine van	1	33.3	33.3	33.3
mobile van screens patient	1	33.3	33.3	66.7
None	1	33.3	33.3	100.0

TABLE 9 - TRAINING CHARACTERISTICS OF TCC PHYSICIANS

CHARACTERISTIC	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
What is the level of training that you have obtained?				
Untrained	2	14.3	14.3	14.3
Less than adequate	6	42.9	42.9	57.1
Adequate	5	35.7	35.7	92.9
More than adequate	1	7.1	7.1	100.0
Have you been trained by the TSP after the installation of the equipment?				
Yes	10	71.4	71.4	71.4
No	4	28.6	28.6	100.0
What was the training period?				
Less than 1 day	1	7.1	7.1	7.1
2-3 days	13	92.9	92.9	100.0
Did the training lack in any respect?				
0	1	7.1	7.1	7.1
Yes	8	57.1	57.1	64.3
No	5	35.7	35.7	100.0
Further training from any other source?				
Yes	1	7.1	7.1	7.1
No	12	85.7	85.7	92.9
3	1	7.1	7.1	100.0
Need further follow-up training				
Yes	12	85.7	85.7	85.7
No	2	14.3	14.3	100.0
Follow-up training to learn about the recent advances in the process				
Yes	10	71.4	71.4	71.4
No	4	28.6	28.6	100.0
Follow-up training to adapt to newer technologies				
Yes	10	71.4	71.4	71.4
No	4	28.6	28.6	100.0
Follow-up training to learn effective methods of consulting				
Yes	10	71.4	71.4	71.4
No	4	28.6	28.6	100.0
Follow-up training to update on standards of care and guidelines				
Yes	9	64.3	64.3	64.3

No	5	35.7	35.7	100.0
Fellow physicians, nurses and paramedical staff adequately trained?				
Yes	3	21.4	21.4	21.4
No	11	78.6	78.6	100.0

TABLE 10 - TSC PHYSICIAN CHARACTERISTICS – TRAINING				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Level of training that you have obtained in telemedicine consulting procedures?				
Less than adequate	2	66.7	66.7	66.7
Adequate	1	33.3	33.3	100.0
Trained by the TSP after the installation of the equipment?				
Yes	3	100.0	100.0	100.0
Training period?				
2-3 days	3	100.0	100.0	100.0
Did the training lack in any aspect?				
Yes	1	33.3	33.3	33.3
No	2	66.7	66.7	100.0
Received further training in telemedicine usage from any other source?				
No	3	100.0	100.0	100.0
Need further follow-up training in telemedicine usage?				
Yes	2	66.7	66.7	66.7
No	1	33.3	33.3	100.0
Require follow-up training to learn about the recent advances in the process				
Yes	2	66.7	66.7	66.7
No	1	33.3	33.3	100.0
Require follow-up training to adapt to newer technologies				
Yes	2	66.7	66.7	66.7
No	1	33.3	33.3	100.0
Require follow-up training to learn effective methods of consulting				
Yes	2	66.7	66.7	66.7
No	1	33.3	33.3	100.0
Require follow-up training to update on standards of care and guidelines				
Yes	3	100.0	100.0	100.0
Are your fellow physicians, nurses and paramedical staff adequately trained in telemedicine use?				
Yes	2	66.7	66.7	66.7
No	1	33.3	33.3	100.0

TABLE 11 - TCC PHYSICIAN CHARACTERISTICS – PATIENT NEEDS				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Frequency of consulting with TSCs for patient needs?				
Rarely	3	21.4	21.4	21.4
Sometimes	5	35.7	35.7	57.1
Often	5	35.7	35.7	92.9
Very often	1	7.1	7.1	100.0
Number of tele-consultations engaged in the last month?				
0	11	78.6	78.6	78.6
12	1	7.1	7.1	85.7
16	1	7.1	7.1	92.9
43	1	7.1	7.1	100.0
Most common reason for consulting the TSC?				
When patient cannot be managed without specialist	5	35.7	35.7	42.9

consultation				
When it is not feasible to refer the patient to a specialty centre	2	14.3	14.3	57.1
To consult regarding a rare disorder or condition	6	42.9	42.9	100.0
Number of tele-diagnosis consultations engaged in the last month?				
0	10	71.4	71.4	71.4
1	1	7.1	7.1	78.6
7	1	7.1	7.1	85.7
10	1	7.1	7.1	92.9
11	1	7.1	7.1	100.0
Did any patients request you to consult with specialist physicians in the last month?				
Yes	2	14.3	14.3	14.3
No	12	85.7	85.7	100.0
Did any patient refuse participating in a teleconsultation with a specialist physician?				
Yes	1	7.1	7.1	7.1
No	13	92.9	92.9	100.0
Who informs the patient about the consultation and the general procedure that follows?				
Administrator	1	7.1	7.1	7.1
Nurse	5	35.7	35.7	42.9
Physician	6	42.9	42.9	85.7
Technical Support Person	2	14.3	14.3	100.0
How do you obtain patient willingness?				
Orally	14	100.0	100.0	100.0

TABLE 12 - TCC PHYSICIAN CHARACTERISTICS – SATISFACTION WITH TELEMEDICINE CONSULTATIONS

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Rate the quality of consultation that is possible through telemedicine?				
Average	10	71.4	71.4	71.4
Good	4	28.6	28.6	100.0
Patient from a TCC stands to gain from a tele-consultation with the TSC specialist team through telemedicine ?				
No	6	42.9	42.9	42.9
Yes	8	57.1	57.1	100.0
Do you think the TSC physicians are able to diagnose conditions accurately through teleconsultation of diagnostic values and physical examination done at TCC?				
No, not very accurately	1	7.1	7.1	7.1
Yes, substantially	10	71.4	71.4	78.6
Yes, very accurately	3	21.4	21.4	100.0
Rate the benefit from the conduct of CME's through telemedicine?				
Have not attended any CME	6	42.9	42.9	42.9
Somewhat satisfying	5	35.7	35.7	78.6
Satisfying	3	21.4	21.4	100.0
Rate the usefulness of telemedicine while engaging in research or other collaborations with other institutes?				
Have not used	5	35.7	35.7	35.7
Somewhat satisfying	6	42.9	42.9	78.6
Satisfying	3	21.4	21.4	100.0

Rate the satisfaction from e-governance meetings conducted through telemedicine?				
Have not used	7	50.0	50.0	50.0
Somewhat satisfying	5	35.7	35.7	85.7
Satisfying	2	14.3	14.3	100.0
Rate the satisfaction from the use of telemedicine for disaster management consultations?				
Have not used	9	64.3	64.3	64.3
Somewhat satisfying	4	28.6	28.6	92.9
Satisfying	1	7.1	7.1	100.0

TABLE 13 - TSC PHYSICIAN CHARACTERISTICS – SATISFACTION WITH TELEMEDICINE CONSULTATIONS

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Rate the quality of consultation that is possible through telemedicine?				
Average	2	66.7	66.7	66.7
Good	1	33.3	33.3	100.0
Patient from a TCC stands to gain from a tele-consultation with your specialist team through telemedicine rather than personally visiting a specialist centre?				
Yes	3	100.0	100.0	100.0
Able to diagnose conditions in the patient accurately through teleconsultation of diagnostic values and the physical examination done by the TCC physician?				
Yes, substantially	3	100.0	100.0	100.0
Rate the benefit from the conduct of CME's through telemedicine?				
Somewhat satisfying	2	66.7	66.7	66.7
Satisfying	1	33.3	33.3	100.0
Rate the usefulness of telemedicine while engaging in research or other collaborations with other institutes?				
Somewhat satisfying	2	66.7	66.7	66.7
Satisfying	1	33.3	33.3	100.0
Rate the satisfaction from e-governance meetings conducted through telemedicine?				
Have not used	2	66.7	66.7	66.7
Somewhat satisfying	1	33.3	33.3	100.0
Rate the satisfaction from the use of telemedicine for disaster management consultations?				
Have not used	3	100.0	100.0	100.0

TABLE 14 - TCC PHYSICIAN CHARACTERISTICS – INCENTIVES TO USE TELEMEDICINE

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Incentives needed by physicians and other staff to use telemedicine to a greater extent?				
Yes	9	64.3	64.3	64.3
No	5	35.7	35.7	100.0
Have any incentive from the centre to engage in telemedicine?				
Yes	1	7.1	7.1	7.1
No	13	92.9	92.9	100.0
What is the kind of incentive being offered?				
No incentive	12	85.7	85.7	85.7
Career Incentive	1	7.1	7.1	92.9
Financial Incentive	1	7.1	7.1	100.0
Would an incentive structure make you engage in				

telemedicine consultations more often?				
Yes	9	64.3	64.3	64.3
No	5	35.7	35.7	100.0

TABLE 15 - TSC PHYSICIAN CHARACTERISTICS – INCENTIVES TO USE TELEMEDICINE				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Do physicians and other staff need incentives to use telemedicine to a greater extent?				
Yes	3	100.0	100.0	100.0
Any incentive from the centre to engage in telemedicine?				
No	3	100.0	100.0	100.0
What is the kind of incentive being offered?				
No incentive	3	100.0	100.0	100.0
Does the incentive structure make you engage in telemedicine consultations more often?				
Yes	3	100.0	100.0	100.0
Is the lack of incentive a cause for the low utilization of telemedicine in your centre				
No	3	100.0	100.0	100.0

TABLE 16 - TCC PHYSICIAN CHARACTERISTICS – RELATIONSHIP WITH TSC PHYSICIANS AND OTHER SPECIALIST PHYSICIANS				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Any of the TSC physicians your personal acquaintances?				
Yes	8	57.1	57.1	57.1
No	6	42.9	42.9	100.0
Frequency of tele-consulting with TSC physicians you are acquainted with than with others?				
No difference	3	21.4	21.4	21.4
Somewhat frequently	8	57.1	57.1	78.6
Very frequently	3	21.4	21.4	100.0
To what extent does familiarity with the TSC physician contribute towards a smoother telemedicine consultation?				
0	1	7.1	7.1	7.1
Not much	2	14.3	14.3	21.4
To a large extent	11	78.6	78.6	100.0
Telemedicine helps build new acquaintances and professional friendships across different centers?				
Yes	13	92.9	92.9	92.9
No	1	7.1	7.1	100.0

TABLE 17 - TSC PHYSICIAN CHARACTERISTICS – RELATIONSHIP WITH TCC PHYSICIANS AND OTHER SPECIALISTS				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Any of the TCC Physicians your personal acquaintances				
Yes	3	100.0	100.0	100.0
Frequency of tele-consulting with TCC physicians you are acquainted with than with others?				
Somewhat frequently	2	66.7	66.7	66.7
More frequently	1	33.3	33.3	100.0
To what extent does familiarity with a TCC physician contribute towards a smoother telemedicine consultation?				
To a large extent	3	100.0	100.0	100.0
Telemedicine helps build new acquaintances and professional friendships				
Yes	3	100.0	100.0	100.0

TABLE 18 - TCC PHYSICIAN CHARACTERISTICS – PERCEIVED NEED FOR TELEMEDICINE				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Frequency of attending professional gatherings/CMEs/interactive seminars/conferences?				
Never	1	7.1	7.1	7.1
Rarely	2	14.3	14.3	21.4
Sometimes	6	42.9	42.9	64.3
Often	2	14.3	14.3	78.6
Quite often	3	21.4	21.4	100.0
Distance from the venue prevents me from attending professional gatherings/CMEs/seminars				
Yes	5	35.7	35.7	35.7
No	9	64.3	64.3	100.0
Travel requirements prevent me from attending professional gatherings/CMEs/seminars				
Yes	3	21.4	21.4	21.4
No	11	78.6	78.6	100.0
Time constraints prevent me from attending professional gatherings/CMEs/seminars				
Yes	6	42.9	42.9	42.9
No	8	57.1	57.1	100.0
Cost of attendance prevents me from attending professional gatherings/CMEs/seminars				
Yes	1	7.1	7.1	7.1
No	13	92.9	92.9	100.0
Work overload prevents me from attending professional. gatherings/CMEs/seminars				
0	1	7.1	7.1	7.1
Yes	6	42.9	42.9	50.0
No	7	50.0	50.0	100.0
Other responsibilities prevent me from attending professional. gatherings/CMEs/seminars				
Yes	1	7.1	7.1	7.1
No	13	92.9	92.9	100.0
Telemedicine-through professional gatherings/CMEs/interactive seminars/conferences can replace the need to travel and attend these events?				
Maybe	1	7.1	7.1	7.1
Not very much	7	50.0	50.0	57.1
Yes, to a large extent	6	42.9	42.9	100.0
The use of telemedicine has been proportionate to its usefulness?				
The use is less and more can be done using telemedicine	11	78.6	78.6	78.6
The use is high but the usefulness is debatable	3	21.4	21.4	100.0

TABLE 19 - TSC PHYSICIAN CHARACTERISTICS – PERCEIVED NEED FOR TELEMEDICINE				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Frequency of attending professional gatherings/CMEs/interactive seminars/conferences				
Rarely	2	66.7	66.7	66.7
Quite often	1	33.3	33.3	100.0
Factors that prevent you from attending professional gatherings/CMEs/interactive seminars/conferences?				
Travel requirements	1	33.3	33.3	33.3
Time constraints	1	33.3	33.3	66.7
Other responsibilities	1	33.3	33.3	100.0
Telemedicine-through professional gatherings/CMEs/interactive seminars/conferences replace the need to travel and attend these events?				
Maybe	1	33.3	33.3	33.3
Not very much	1	33.3	33.3	66.7
Yes, to a large extent	1	33.3	33.3	100.0

Feel the use of telemedicine has been proportionate to its usefulness?				
The use is less and more can be done using telemedicine	3	100.0	100.0	100.0

TABLE 20 - CHARACTERISTICS OF TCC ADMINISTRATORS – WILLINGNESS TO USE TELEMEDICINE				
CHARACTERISTIC	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Frequency of Telemedicine Consultations				
1-2 times a week	5	71.4	71.4	71.4
Daily	2	28.6	28.6	100.0
Most common type of consultation engaged in				
Patient consultations with TSCs	3	42.9	42.9	42.9
Tele-diagnosis consultations with TSCs	4	57.1	57.1	100.0
Mechanism of recording and informing personnel regarding consultation schedules and appointments				
Maintain a log book	6	85.7	85.7	85.7
Convey orally	1	14.3	14.3	100.0
How do you ensure adequate utilization of telemedicine facilities?				
Encourage personnel to use	6	85.7	85.7	85.7
Monitor use and recommend at times	1	14.3	14.3	100.0
Do you encourage the use of telemedicine by your personnel?				
Yes	3	42.9	42.9	42.9
No	4	57.1	57.1	100.0
Method of encouragement used				
Encourage usage	1	14.3	14.3	14.3
Give faculty time to attend to telemedicine	1	14.3	14.3	28.6
None	3	42.9	42.9	71.4
Repeated pursuing	1	14.3	14.3	85.7
Send doctors on rotation	1	14.3	14.3	100.0
Best way to encourage personnel to use telemedicine?				
Motivation	4	57.1	57.1	57.1
Repeated re-enforcing	2	28.6	28.6	85.7
Proving incentives	1	14.3	14.3	100.0

TABLE 21 - TSC ADMINISTRATOR CHARACTERISTICS – WILLINGESS TO USE TELEMEDICINE				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Frequency of your centre engaging in telemedicine consultations?				
Few times a month	1	25.0	25.0	25.0
Daily	3	75.0	75.0	100.0
What is the most common type of consultation your centre engages in? (tick any one				
TCC requests for patient consultations	2	50.0	50.0	50.0
Tele-diagnosis requests	2	50.0	50.0	100.0
Maintain a log book to inform personnel regarding consultation schedules and appointments				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
Convey orally to inform personnel regarding consultation schedules and appointments				
Yes	4	100.0	100.0	100.0
Use other communication devices to inform personnel regarding consultation schedules and appointments				
No	4	100.0	100.0	100.0

Time taken to respond to a consultation request from a TCC?				
Immediately	3	75.0	75.0	75.0
Within 30 minutes	1	25.0	25.0	100.0
How do you ensure adequate utilization of telemedicine facilities?				
Encourage personnel to use	2	50.0	50.0	50.0
Monitor use and recommend at times	2	50.0	50.0	100.0
Any method to encourage the use of telemedicine by your personnel?				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0
What method you have used to encourage use?				
Incentives, recognition	1	25.0	25.0	25.0
Individual responsibility, recognition	1	25.0	25.0	50.0
None	1	25.0	25.0	75.0
Recognition	1	25.0	25.0	100.0
The best way to encourage personnel to use telemedicine?				
Motivation	1	25.0	25.0	25.0
Repeated re-enforcing	3	75.0	75.0	100.0

TABLE 22 - CHARACTERISTICS OF TCC ADMINISTRATOR – STAFFING

CHARACTERISTIC	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Number of consulting physicians				
0	1	14.3	14.3	14.3
1	2	28.6	28.6	42.9
2	2	28.6	28.6	71.4
3	1	14.3	14.3	85.7
6	1	14.3	14.3	100.0
Number of Nurses				
1	1	14.3	14.3	14.3
2	3	42.9	42.9	57.1
3	1	14.3	14.3	71.4
6	1	14.3	14.3	85.7
15	1	14.3	14.3	100.0
Number of para-medical staff				
0	1	14.3	14.3	14.3
1	3	42.9	42.9	57.1
4	1	14.3	14.3	71.4
5	1	14.3	14.3	85.7
6	1	14.3	14.3	100.0
Number of medical coordinators				
0	7	100.0	100.0	100.0
Number of technical support personnel				
0	1	14.3	14.3	14.3
1	5	71.4	71.4	85.7
2	1	14.3	14.3	100.0
Maintain the same staff strength throughout the year				
Yes	4	57.1	57.1	57.1
No	3	42.9	42.9	100.0
Have difficulty in obtaining trained staff				
Yes	5	71.4	71.4	71.4
No	2	28.6	28.6	100.0
Have difficulty in retaining trained staff				
Yes	3	42.9	42.9	42.9
No	4	57.1	57.1	100.0
Inability to recruit more staff due to financial restrictions				
Yes	6	85.7	85.7	85.7
No	1	14.3	14.3	100.0
Have absenteeism of workers				
Yes	3	42.9	42.9	42.9
No	4	57.1	57.1	100.0

Have unfilled staff positions				
Yes	6	85.7	85.7	85.7
No	1	14.3	14.3	100.0
Non-scheduling of consultation				
Yes	3	42.9	42.9	42.9
No	4	57.1	57.1	100.0
Lack of time				
Yes	3	42.9	42.9	42.9
No	4	57.1	57.1	100.0
Busy with other responsibilities				
Yes	4	57.1	57.1	57.1
No	3	42.9	42.9	100.0
Lack of initiative among staff				
Yes	1	14.3	14.3	14.3
No	6	85.7	85.7	100.0
Lack of financial incentives				
Yes	2	28.6	28.6	28.6
No	5	71.4	71.4	100.0

TABLE 23 - TSC ADMINISTRATOR CHARACTERISTICS – STAFFING				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Number of Specialist Physicians				
2	3	75.0	75.0	75.0
3	1	25.0	25.0	100.0
Number of nurses				
2	1	25.0	25.0	25.0
4	3	75.0	75.0	100.0
Number of Para-medical staff				
3	1	25.0	25.0	25.0
4	1	25.0	25.0	50.0
5	2	50.0	50.0	100.0
Number of Medical Coordinators				
1	1	25.0	25.0	25.0
2	3	75.0	75.0	100.0
Number of Technical Support Personnel				
1	1	25.0	25.0	25.0
3	1	25.0	25.0	50.0
5	2	50.0	50.0	100.0
Required number of Specialist Physicians				
2	1	25.0	25.0	25.0
4	3	75.0	75.0	100.0
Required Number of Nurses				
4	3	75.0	75.0	75.0
5	1	25.0	25.0	100.0
Required Number of Para-medical personnel				
0	1	25.0	25.0	25.0
4	2	50.0	50.0	75.0
5	1	25.0	25.0	100.0
Required number of medical coordinators				
2	4	100.0	100.0	100.0
Required number of Technical Support Personnel				
1	1	25.0	25.0	25.0
2	1	25.0	25.0	50.0
3	1	25.0	25.0	75.0
5	1	25.0	25.0	100.0
Maintain the same staff strength throughout the year?				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
Difficulty in obtaining trained staff				
Yes	4	100.0	100.0	100.0
Difficulty in retaining staff				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0
Inability to recruit more staff due to financial				

restrictions				
Yes	1	25.0	25.0	25.0
No	3	75.0	75.0	100.0
Commonest staffing problem that you face that leads to less than optimal usage of telemedicine applications				
Unfilled staff positions	1	25.0	25.0	25.0
Busy with other responsibilities	1	25.0	25.0	50.0
9	2	50.0	50.0	100.0
How do you ensure that staffing problems do not affect telemedicine activities?				
Career growth	1	25.0	25.0	25.0
Handle staff problems immediately	1	25.0	25.0	50.0
None	1	25.0	25.0	75.0
Payroll Incentives, training/retraining	1	25.0	25.0	100.0

TABLE 24 - CHARACTERISTICS OF TCC ADMINSTRATOR – TRAINING OF STAFF

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Overall level of training of your staff				
Poor	1	14.3	14.3	14.3
Less than adequate	5	71.4	71.4	85.7
Adequate	1	14.3	14.3	100.0
Proportion of your staff that received post-implementation training from the TSP				
None of them	3	42.9	42.9	42.9
Few of them	3	42.9	42.9	85.7
Most of them	1	14.3	14.3	100.0
Category of staff which had the maximum amount of training				
Specialist Physician	1	14.3	14.3	14.3
Nurses	4	57.1	57.1	71.4
Technical Support Personnel	2	28.6	28.6	100.0
TCC Carried out dry runs using test and non-patient data				
No	7	100.0	100.0	100.0
Feel staff needs further follow-up training in telemedicine consultations				
Yes	7	100.0	100.0	100.0
How often have you organized follow-up training for your staff				
Once in 6 months	4	57.1	57.1	57.1
Once a year	3	42.9	42.9	100.0
How do you ensure that staff at your centre are trained in the use of telemedicine application				
Schedule follow-up training for staff	2	28.6	28.6	28.6
Ensure trained staff are retained	5	71.4	71.4	100.0

TABLE 25 - TSC ADMINISTRATOR CHARACTERISTICS - TRAINING

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Rate the overall level of training of your staff				
Less than adequate	2	50.0	50.0	50.0
Adequate	2	50.0	50.0	100.0
Proportion of your staff that received post-implementation training from the TSP?				
Few of them	1	25.0	25.0	25.0
Most of them	2	50.0	50.0	75.0
All of them	1	25.0	25.0	100.0
Category of staff with maximum amount of training in the post-implementation phase?				
Nurses	1	25.0	25.0	25.0
Medical Co-coordinator	1	25.0	25.0	50.0
Technical Support Personnel	2	50.0	50.0	100.0
Carried out dry runs using test and non-patient data?				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0

Staff need further follow-up training in telemedicine consultations?				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
Have you organized follow-up training for your staff?				
Once in 6 months	2	50.0	50.0	50.0
Never	2	50.0	50.0	100.0
How do you ensure that staff are trained in the use of telemedicine applications?				
Recruit trained staff	1	25.0	25.0	25.0
Schedule follow-up training for staff	2	50.0	50.0	75.0
Encourage staff to undergo training elsewhere	1	25.0	25.0	100.0

TABLE 26 - CHARACTERISTICS OF TCC ADMINISTRATORS – COSTS, FUNDING AND SELF – SUSTENANCE

CHARACTERISTIC	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
TCC financially self-sufficient to cover operational costs of telemedicine				
Yes	1	14.3	14.3	14.3
No	6	85.7	85.7	100.0
Maximum proportion of your telemedicine expenditure covered by any of these sources				
Government Support	5	71.4	71.4	71.4
Support from other agencies	1	14.3	14.3	85.7
Charging patients	1	14.3	14.3	100.0
Facing problem with managing the costs of telemedicine usage				
No, do not find it difficult at all	3	42.9	42.9	42.9
A slight inconvenience	3	42.9	42.9	85.7
Yes, find it difficult to manage costs	1	14.3	14.3	100.0
Plans for sustaining the TCC if the government/other agency assistance is withdrawn				
Institution of user charges	6	85.7	85.7	85.7
Seeking external support	1	14.3	14.3	100.0

TABLE 27 - TCC ADMINISTRATOR CHARACTERISTICS – COSTS, FUNDING AND SELF SUSTENANCE

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Financially self-sufficient TSC to cover operational costs of telemedicine?				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
Maximum proportion of your telemedicine expenditure covered by any of these sources?				
Governmental Support	1	25.0	25.0	25.0
Funded by the parent institution	3	75.0	75.0	100.0
Administrative staff salaries				
Fully met	4	100.0	100.0	100.0
Physician salaries				
Fully met	4	100.0	100.0	100.0
Nursing and paramedical staff salaries				
Fully met	4	100.0	100.0	100.0
Technical support team salaries				
Fully met	4	100.0	100.0	100.0
Medical co-coordinator salaries				
Rent for the premises				
Fully met	4	100.0	100.0	100.0
Office equipment (computers, furniture, etc				
Fully met	4	100.0	100.0	100.0
Stationery, fax, other office supplies				
Fully met	4	100.0	100.0	100.0
Miscellaneous telemedicine supplies				
Fully met	4	100.0	100.0	100.0
Telemedicine connectivity costs				

Fully met	4	100.0	100.0	100.0
Telemedicine equipment and diagnostic equipment				
Fully met	4	100.0	100.0	100.0
Equipment maintenance costs				
Fully met	4	100.0	100.0	100.0
Are you facing any problem with managing the costs of telemedicine usage?				
Yes, find it difficult to manage costs	1	25.0	25.0	25.0
No, do not find it difficult at all	3	75.0	75.0	100.0
What are the plans for sustaining the TCC if the government/other agency assistance is withdrawn? (click one)				
Own institution funding	3	75.0	75.0	75.0
Institution of user charges	1	25.0	25.0	100.0

TABLE 28 - CHARACTERISTICS OF TCC ADMINISTRATOR – SAFETY, SECURITY AND CONFIDENTIALITY OF PATIENT RECORDS

CHARACTERISTIC	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Who maintains the patient record databases regularly at your centre				
Technical support personnel	5	71.4	83.3	83.3
Administrator	1	14.3	16.7	100.0
Any case of breach of safety, security and confidentiality of patient records in your centre				
No	7	100.0	100.0	100.0
Guidelines for maintaining safety, security and confidentiality of patient records				
Yes	5	71.4	71.4	71.4
No	2	28.6	28.6	100.0
Which guidelines for maintaining safety/security/confidentiality of data				
Medical Records standards	1	14.3	14.3	14.3
Not known	6	85.7	85.7	100.0
How are the patient record databases kept safe, secure and confidential				
The databases are password-protected	3	42.9	42.9	42.9
A designated person monitors this aspect routinely	4	57.1	57.1	100.0
Upload patient records to other referral centers where the patient might be referred				
Yes	4	57.1	57.1	57.1
No	3	42.9	42.9	100.0

TABLE 29 - TCC ADMINISTRATOR CHARACTERISTICS – SAFETY, SECURITY AND CONFIDENTIALITY OF PATIENT RECORDS

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Who maintains the patient record databases regularly at your centre?				
Technical Support Personnel	4	100.0	100.0	100.0
Any case of breach of safety, security and confidentiality of patient records in your centre?				
No	4	100.0	100.0	100.0
Follow any guidelines for maintaining safety, security and confidentiality of patient records?				
Yes	4	100.0	100.0	100.0
Mention which guidelines used for safety, security and confidentiality?				
ISRO guidelines	1	25.0	25.0	25.0
None	3	75.0	75.0	100.0
How are patient record databases kept safe, secure and confidential in your centre?				
The databases are password-protected	2	50.0	50.0	50.0
A designated person monitors this aspect routinely	2	50.0	50.0	100.0
Upload patient records to other referral centers				

where patient is referred?				
Yes	4	100.0	100.0	100.0

TABLE 30 - TCC TECHNICIAN PROPERTIES – TELEMEDICINE ROOM				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Have a designated telemedicine room for consultations?				
Yes	11	84.6	84.6	84.6
No	2	15.4	15.4	100.0
Size of your telemedicine consultation room?				
12' x 20'	4	30.8	30.8	30.8
15' x 30'	4	30.8	30.8	61.5
Any Other	5	38.5	38.5	100.0
Telemedicine consultations are possible				
Yes	12	92.3	92.3	92.3
No	1	7.7	7.7	100.0
Tele-diagnosis consultations are possible				
0	1	7.7	7.7	7.7
Yes	5	38.5	38.5	46.2
No	7	53.8	53.8	100.0
CMEs are possible				
Yes	2	15.4	15.4	15.4
No	11	84.6	84.6	100.0
Inter-professional discussions are possible				
Yes	3	23.1	23.1	23.1
No	10	76.9	76.9	100.0
E-health governance is possible				
No	13	100.0	100.0	100.0
Any other use possible (mention)				
No	13	100.0	100.0	100.0
Relevant equipment and connections are available				
Yes	13	100.0	100.0	100.0
Power backup is available				
Yes	10	76.9	76.9	76.9
No	3	23.1	23.1	100.0
Size and space is available				
Yes	12	92.3	92.3	92.3
No	1	7.7	7.7	100.0
Room temperature control is available				
Yes	12	92.3	92.3	92.3
No	1	7.7	7.7	100.0
Acoustics is available				
Yes	12	92.3	92.3	92.3
No	1	7.7	7.7	100.0
Desired type of flooring				
Yes	13	100.0	100.0	100.0
Required illumination is available				
Yes	13	100.0	100.0	100.0
Appropriate color of the room				
Yes	13	100.0	100.0	100.0
Telemedicine room based on any guidelines?				
Yes	9	69.2	69.2	69.2
No	4	30.8	30.8	100.0
If yes, which guidelines?				
ISRO	3	23.1	23.1	23.1
No idea	10	76.9	76.9	100.0
Normal duration of operation of your telemedicine room?				
8 hours daytime	10	76.9	76.9	76.9
More than 8 hours daytime	2	15.4	15.4	92.3
Round the clock (24 hours)	1	7.7	7.7	100.0

TABLE 31 - TSC TECHNICIAN CHARACTERISTICS – TELEMEDICINE ROOM				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Have a designated telemedicine room for consultations?				
Yes	4	100.0	100.0	100.0
Size of your telemedicine consultation room?				
12' x 20'	2	50.0	50.0	50.0
15' x 30'	1	25.0	25.0	75.0
Any other	1	25.0	25.0	100.0
Telemedicine consultations are possible in the room				
Yes	4	100.0	100.0	100.0
Tele-diagnosis consultations are possible in the room				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
CMEs are possible in our room				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
Inter-professional discussions are possible in the room				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0
E-health governance is possible in the room				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0
Any other use is possible in the room				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0
Have relevant equipment and connections				
Yes	4	100.0	100.0	100.0
Have power backup				
Yes	4	100.0	100.0	100.0
Have size and space				
Yes	4	100.0	100.0	100.0
Have room temperature control				
Yes	4	100.0	100.0	100.0
Have acoustics				
Yes	4	100.0	100.0	100.0
Have the desired type of flooring				
Yes	4	100.0	100.0	100.0
Have the required illumination				
Yes	4	100.0	100.0	100.0
Have the required color of the room				
Yes	4	100.0	100.0	100.0
Telemedicine room based on any guidelines?				
Yes	1	25.0	25.0	25.0
No	3	75.0	75.0	100.0
Which guidelines for the room?				
ISRO	1	25.0	25.0	25.0
None	3	75.0	75.0	100.0
Normal duration of operation of your telemedicine room?				
8 hours daytime	1	25.0	25.0	25.0
Round the clock (24 hours)	3	75.0	75.0	100.0

TABLE 32 - TCC TECHNICIAL CHARACTERISTICS – TELEMEDICINE DEVICES AND DIAGNOSTIC EQUIPMENT				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Problems with telemedicine devices and diagnostic equipment in the past month?				
Yes	7	53.8	53.8	53.8
No	6	46.2	46.2	100.0
Frequency of problems with the information technology (IT) hardware in your centre?				

1-2 times/25 consultations	2	15.4	15.4	15.4
1-2 times/10 consultations	3	23.1	23.1	38.5
1-2 times/5 consultations	8	61.5	61.5	100.0
Frequency of problems with connectivity hardware?				
0	1	7.7	7.7	7.7
1-2 times/25 consultations	2	15.4	15.4	23.1
1-2 times/10 consultations	5	38.5	38.5	61.5
1-2 times/5 consultations	5	38.5	38.5	100.0
Frequency of problems with video conferencing hardware?				
0	1	7.7	7.7	7.7
1-2 times/25 consultations	4	30.8	30.8	38.5
1-2 times/10 consultations	4	30.8	30.8	69.2
1-2 times/5 consultations	4	30.8	30.8	100.0
Frequency of problems with essential diagnostic hardware				
0	1	7.7	7.7	7.7
1-2 times/25 consultations	6	46.2	46.2	53.8
1-2 times/10 consultations	3	23.1	23.1	76.9
1-2 times/5 consultations	3	23.1	23.1	100.0
Approximate downtime caused by these equipment problems to the centre?				
0	1	7.7	7.7	7.7
1-2 days	7	53.8	53.8	61.5
1 week	5	38.5	38.5	100.0
Time taken for service maintenance or repair teams to reach the centre				
0	1	7.7	7.7	7.7
1 week	6	46.2	46.2	53.8
More than a week	4	30.8	30.8	84.6
4	2	15.4	15.4	100.0
Equipment service provider				
ISRO, Televital & Infinium	13	100.0	100.0	100.0

TABLE 33 - TSC TECHNICIAN CHARACTERISTICS – TELEMEDICINE DEVICES AND DIAGNOSTIC EQUIPMENT

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Any problems with telemedicine devices and diagnostic equipment in the past month?				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0
Frequency of problems with the information technology (IT) hardware in your centre?				
1-2 times/25 consultations	2	50.0	50.0	50.0
1-2 times/10 consultations	1	25.0	25.0	75.0
1-2 times/5 consultations	1	25.0	25.0	100.0
Frequency of problems with connectivity hardware?				
1-2 times/25 consultations	3	75.0	75.0	75.0
1-2 times/10 consultations	1	25.0	25.0	100.0
Frequency of problems with video conferencing hardware?				
1-2 times/25 consultations	3	75.0	75.0	75.0
1-2 times/5 consultations	1	25.0	25.0	100.0
Frequency of problems with essential diagnostic hardware				
1-2 times/25 consultations	3	75.0	75.0	75.0
1-2 times/5 consultations	1	25.0	25.0	100.0
Approximate downtime caused by these equipment problems to the centre?				
1-2 days	1	25.0	25.0	25.0
1 week	2	50.0	50.0	75.0
More than a week	1	25.0	25.0	100.0
Time taken for service maintenance or repair teams to reach the centre				

Same day	1	25.0	25.0	25.0
1-2 days	3	75.0	75.0	100.0
Equipment service provider?				
Televital, Infinium & BEL	4	100.0	100.0	100.0

TABLE 34 - TCC TECHNICIAN CHARACTERISTICS – CONNECTIVITY

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Type of connection used by TCC				
ISDN	2	15.4	15.4	15.4
VSAT	11	84.6	84.6	100.0
Problems in getting connected in the last month?				
Yes	7	53.8	53.8	53.8
No	6	46.2	46.2	100.0
Frequency of problems with connectivity occurred				
1-2 times/25 consultations	3	23.1	23.1	23.1
1-2 times/10 consultations	7	53.8	53.8	76.9
1-2 times/5 consultations	3	23.1	23.1	100.0
Whom do you contact when you are not getting connected?				
Telemedicine Service Provider	11	84.6	84.6	84.6
ISRO	1	7.7	7.7	92.3
Any other agency	1	7.7	7.7	100.0
Get immediate assistance from the telemedicine connection provider?				
Yes	13	100.0	100.0	100.0

TABLE 35 - TSC TECHNICIAN CHARACTERISTICS – CONNECTIVITY

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
ISDN connection				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
Broadband connection				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
VSAT connection				
Yes	4	100.0	100.0	100.0
Problems in getting connected in the last month?				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0
Frequency of problems with connectivity occurred:				
1-2 times/25 consultations	2	50.0	50.0	50.0
1-2 times/10 consultations	1	25.0	25.0	75.0
1-2 times/5 consultations	1	25.0	25.0	100.0
Whom do you contact when you are not getting connected?				
Telemedicine Service Provider	2	50.0	50.0	50.0
ISRO	1	25.0	25.0	75.0
Any other agency	1	25.0	25.0	100.0
Do you get immediate assistance from the telemedicine connection provider?				
Yes	4	100.0	100.0	100.0

TABLE 36 - TCC TECHNICIAL PROPERTIES – QUALITY OF IMAGES AND SPEED OF TRANSMISSION

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Any problems with the quality of images in the last month?				
Yes	3	23.1	23.1	23.1
No	10	76.9	76.9	100.0
What are the problems with quality of images?				
Hazy	1	7.7	7.7	7.7
None	12	92.3	92.3	100.0
Frequency of problems in data quality				

1-2 times/25 consultations	4	30.8	30.8	30.8
1-2 times/10 consultations	1	7.7	7.7	38.5
1-2 times/5 consultations	8	61.5	61.5	100.0
Have problems with the speed of transmission?				
Yes	4	30.8	30.8	30.8
No	9	69.2	69.2	100.0
what are the problems with speed of transmission				
None	10	76.9	76.9	76.9
One-way voice, slow communication	1	7.7	7.7	84.6
Slow conversations	2	15.4	15.4	100.0
Frequency of problems in speed of transmission occur?				
1-2 times/25 consultations	5	38.5	38.5	38.5
1-2 times/10 consultations	5	38.5	38.5	76.9
1-2 times/5 consultations	3	23.1	23.1	100.0
Poor quality of images and reduced speed of transmission hampers consultation process?				
Yes	8	61.5	61.5	61.5
No	5	38.5	38.5	100.0

TABLE 37 - TSC TECHNICIAN CHARACTERISTICS – QUALITY OF IMAGES AND SPEED OF TRANSMISSION

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Problems with the quality of images, eg. Resolution in the last month?				
No	4	100.0	100.0	100.0
Frequency of problems in data quality occur?				
1-2 times/25 consultations	4	100.0	100.0	100.0
Problems with the speed of transmission?				
1	2	50.0	50.0	50.0
2	2	50.0	50.0	100.0
What are the problems with speed of transmission?				
Images frozen, break in audio and video	1	25.0	25.0	25.0
None	3	75.0	75.0	100.0
Frequency of problems in speed of transmission occur?				
1-2 times/25 consultations	1	25.0	25.0	25.0
1-2 times/10 consultations	1	25.0	25.0	50.0
1-2 times/5 consultations	1	25.0	25.0	75.0
Every time	1	25.0	25.0	100.0
Does poor quality of images and reduced speed of transmission hamper your consultation process?				
Yes	4	100.0	100.0	100.0

TABLE 38 - TCC TECHNICIAL CHARACTERISTICS - SERVICE AND MAINTENANCE

CHARACTERISTICS	FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Have an annual maintenance contract with a service agency for service and maintenance				
Yes	9	69.2	69.2	69.2
No	4	30.8	30.8	100.0
Average time taken by the service agency to report to the centre and inspect the problem?				
1-2 days	2	15.4	15.4	15.4
Within 1 week	9	69.2	69.2	84.6
More than a week	2	15.4	15.4	100.0
What is the average downtime your centre faces when equipment failures occur?				
1-2 days	2	15.4	15.4	15.4
Less than a week	7	53.8	53.8	69.2
More than a week	4	30.8	30.8	100.0
What action for minor equipment breakdowns?				
Report and wait for the service agency	12	92.3	92.3	92.3
Try setting it right yourself	1	7.7	7.7	100.0

Level of training to handle minor equipment breakdowns in the centre?				
Not trained	11	84.6	84.6	84.6
Somewhat trained	1	7.7	7.7	92.3
Adequately trained	1	7.7	7.7	100.0
How do you ensure that equipment breakdowns are reduced to a large extent?				
Using equipment with care	9	69.2	69.2	69.2
Regular service and maintenance	2	15.4	15.4	84.6
Immediate correction of minor problems	2	15.4	15.4	100.0
Rate your centre in terms of service and maintenance capability and preparedness?				
Well serviced and maintained	8	61.5	61.5	61.5
Moderately serviced and maintained	5	38.5	38.5	100.0

TABLE 39 - TSC TECHNICIAN CHARACTERISTICS – SERVICE AND MAINTAINENCE				
CHARACTERISTICS	**FREQUENCY**	**PERCENT**	**VALID PERCENT**	**CUMULATIVE PERCENT**
Do you have an annual maintenance contract with a service agency for service and maintenance?				
Yes	1	25.0	25.0	25.0
No	3	75.0	75.0	100.0
Average time taken by the service agency to report to the centre and inspect the problem?				
Same day	1	25.0	25.0	25.0
1-2 days	3	75.0	75.0	100.0
Average downtime your centre faces when equipment failures occur?				
1-2 days	4	100.0	100.0	100.0
What do you do when there are minor equipment breakdowns?				
Report and wait for the service agency	2	50.0	50.0	50.0
Seek other assistance	2	50.0	50.0	100.0
How trained are you to handle minor equipment breakdowns in the centre?				
Not trained	1	25.0	25.0	25.0
Somewhat trained	2	50.0	50.0	75.0
Adequately trained	1	25.0	25.0	100.0
Use equipment with care to ensure breakdowns are reduced				
Yes	4	100.0	100.0	100.0
Do regular service and maintenance to ensure breakdowns are reduced				
Yes	3	75.0	75.0	75.0
No	1	25.0	25.0	100.0
Immediately correct minor problems to reduce equipment breakdowns				
Yes	2	50.0	50.0	50.0
No	2	50.0	50.0	100.0
How do you rate your centre in terms of service and maintenance capability and preparedness				
Moderately serviced and maintained	1	25.0	25.0	25.0
Well serviced and maintained	3	75.0	75.0	100.0

F. TECHNICAL DEFINITIONS USED:

(From Telemedicine Manual – Guidebook for Practice of Telemedicine, Indian Space Research Organization (ISRO), Department of Space, Government of India, May 2005)

Telemedicine:

The World Health Organization defines Telemedicine as, "The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities".

Telemedicine:

Telemedicine is the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education and training, public health and health administration

(Source - HRSA/OAT: http://telemedicine.hrsa.gov/welcome.htm)

Teleconsultation:

Teleconsultation is the use of information and communications technology to enable clinical consultation between geographically separated individuals such as health care professionals and their patients or health care professionals engaged in diagnostic, mentoring, or other clinical decision-making activities related to the delivery of health care services. (Source: http://www.hc-sc.gc.ca)

Tele-treatment:

Treatment provided to the patient through Telemedicine. The specialist at the Specialty Center could advise the consulting doctor at the Consulting Center about the course of treatment to be taken.

Patient Information Record (PIR):

All information pertaining to the patient for providing care using telemedicine. This included clinical as well as non-clinical information.

Telemedicine Consultation Center (TCC):

Telemedicine Consulting Center is the site where the patient is present. In a Telemedicine Consulting Center, equipment for scanning /converting, transformation, communicating for medical information of the patient can be available but it is not essential. A Telemedicine Consulting Center usually has a General Practitioner or in very remote locations a Registered Medical Practitioner who will be able to communicate to the TSC the symptoms/problems of the patient.

Telemedicine Specialty Center (TSC):

Telemedicine Specialty Center is a site, where the specialist is present. He can interact with the patient present in the remote site and view his reports and monitor his progress. A Specialty Center is generally located in a Specialty or Super Specialty hospital catering to specific specialties or all specialties.