

“Slow and Steady Wins the Race”

A Case Study on Infrastructural Development of Telemedicine Services at Dhulikhel Hospital, Nepal

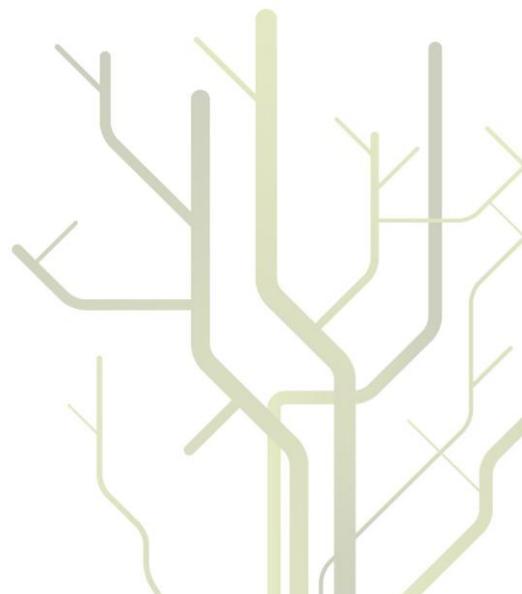


Pritam Lal Shrestha

TLM-3902

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MASTER’S THESIS IN TELEMEDICINE AND E-HEALTH

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BY

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DEDICATION

“Rome was not built in a day”

My parents used to inspire me by quoting this proverb since childhood.

I hereby dedicate this thesis to my beloved parents. Their blessings and moral support has always motivated me to work hard and climb the pillars of success.

Love you maa and baa.

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ABSTRACT

The use of ICT in the medical field has given rise to a new dimension so called telemedicine. Telemedicine is not a new concept, but the level of use differs between the developed and the developing countries, because of the limited infrastructural development and high expenses of technology in the later case. Though it is certain that using ICT in healthcare will improve health status of the nation, answers to the questions like which technology to choose; and what strategy to follow in order to achieve maximum benefit from minimum investment is still under consideration for developing countries.

This study was carried out at Dhulikhel Hospital to explore the infrastructural development of telemedicine, its usage, benefits and users' perspectives on the stability and sustainability of the services in future with context to hospitals in Nepal. A qualitative method with interpretive research approach was chosen for the study using informal discussions, observation and semi-structured interviews with open-ended questionnaires as data collection tools. The empirical findings have been generalized via Information Infrastructure (II) and Actor Network Theory (ANT) as theoretical framework.

The findings from the study indicate that telemedicine is not simply technology; rather it is teamwork which requires good relationship between the users and good understanding of the setup. Furthermore, the study concludes that even a simple technology if implemented with proper vision and strategy can save many lives, and sustainability with telemedicine for developing countries can be achieved through slow and steady progression.

Key words: Telemedicine, Nepal, sustainability, strategy, slow and steady progression.

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LIST OF ABBREVIATIONS

ANM	Auxiliary Nursing Mother
ANT	Actor Network Theory
ATA	American Telemedicine Association
CBS	Central Bureau of Statistics
CCU	Coronary Care Unit
CIA	Central Intelligence Agency
CRP	Centre for the Rehabilitation of the Paralysed
DHO	District Health Office
GDP	Gross Domestic Product
GP	General Practitioner
GSM	Global System for Mobile Communications
HA	Health Assistant
HC	Health Centre
HP	Health Post
ICU	Intensive Care Unit
II	Information Infrastructure
IS	Information System
ISDN	Integrated Service Digital Network
IT	Information Technology

IV	Intravenous
Kb	Kilobyte
Kbps	Kilobyte per second
Km	Kilometer
MCHW	Maternal and Child Health Worker
MoHP	Ministry of Health and Population
NASA	The National Aeronautics and Space Agency
NGO	Non-Government Organization
NICU	Neonatal Intensive Care Unit
NST	Norwegian Centre for Integrated Care and Telemedicine
NTC	Nepal Telecommunications Corporation
PCIS	Patient Care Information System
PHC-C	Primary Health Care Centre
PICU	Paediatric Intensive Care Unit
PPH	Postpartum Hemorrhage
R & D	Research and Development
RCT	Randomized Controlled Trial
SHP	Sub-Health Post
Sq. Km	Square Kilometer
TV	Television

UK	United Kingdom
USA	United States of America
VDC	Village Development Committee
WHO	World Health Organization

CHAPTER 1
INTRODUCTION

1. INTRODUCTION

Nepal is one of the poorest countries in the world where majority of people are living in the rural areas. These rural areas have limited access to the facilities like roads, telecommunications, electricity as well as basic medical treatment. People residing in these areas have to travel for hours and sometimes even for days to reach the nearest health post. Even when they reach the nearest health centre, the doctors are deficient. In such cases, travelling another long journey towards the hospital is the only alternative with the patients, and during this period anything can happen to him/her.

The use of information and communication technologies (ICT) in the medical field has given rise to a new dimension so called telemedicine. By the use of ICT tools, medical consultations can be done with the health workers at the rural health centres, and accordingly guided for diagnosis, treatment or referral by a specialist doctor at the hospital. Telemedicine has therefore created a hope to provide quality health services in those areas.

Telemedicine is not a new concept, since it was developed around a century ago by performing consultations via telephone, and now videoconferencing is one the best telemedicine applications in developed countries. In contrast, telemedicine has just started to emerge in the developing countries and implementing internet based telemedicine applications in the rural areas is still not reasonable. This is because of the limited development in the field of telecommunications; as such the rural areas of some developing nations are even deprived of basic telephone lines (Martinez, Villarroel, Seoane, & Del Pozo, 2004). Moreover, the high cost of technology and low level of knowledge on information technology (IT) prohibits the users from accepting these technologies immediately into their regular work practice. Hence, achieving widespread use and maintaining sustainability with telemedicine in developing countries is a challenging task.

Many developing countries have started to implement telemedicine applications either through their own telemedicine networks (Geissbuhler, Ly, Lovis, & L'Haire, 2003; Gulube & Wynchank, 2001) or through networks linked to the developed countries

(Graham, Zimmerman, Vassallo, Patterson, & Swinfen, 2003; Reznik, Marcin, & Ozuah, 2004; Vassallo et al., 2001; Vassallo, Swinfen, Swinfen, & Wootton, 2001). On the other hand many of the pilot telemedicine projects have not been able to scale-up despite of the success (Wright, 1999). The main reason to this failure is the lack of funding to continue the ongoing services.

It is certain that using ICT in healthcare will improve health status of the nation, but regarding developing countries the answer to the questions like which technology to choose; and what strategy to follow in order to achieve maximum benefit from minimum investment is still under consideration.

Therefore, this study aims to answer following research questions:

- i. How can widespread use of telemedicine be achieved in regular health practice?
- ii. What strategies should be followed to maintain sustainability?
- iii. What is the state of telemedicine infrastructure at hospitals in Nepal?
- iv. Why telemedicine services have become a need in rural health centres?
- v. What are the different interests and expectations of health professionals regarding telemedicine services?
- vi. How should socio-technical actors cooperate for successful teleconsultation?

The study was carried out at Dhulikhel Hospital to explore the infrastructural development of telemedicine, its usage, benefits and users' perspectives on the stability and sustainability of the services in future with context to hospitals in Nepal. The study followed qualitative methodology with interpretive research approach (Klein & Myers, 1999; Walsham, 1995, 2006). The major data collection tools were informal discussions, observation and semi-structured interviews with open-ended questionnaires.

The motivation behind conducting this study is my interest on the use of ICT in health sector. Since telemedicine is a noble approach to improve the health status of the

developing nations and my home country - Nepal being one of them also encouraged me for the study.

This thesis presents the current telemedicine status at one of the hospitals of Nepal and focuses on the strategic development of telemedicine infrastructure. However, it may not resemble the telemedicine scenario of the whole nation but the findings of the study can be taken as reference for further research in the subject matter with multiple institutions as the research site.

The thesis is organized in seven chapters as follows:

Chapter 1 gives the background information on the research problem, context and introduction of the study.

Chapter 2 is the literature review section which consists of an overview of the definition and types of telemedicine; a brief history of telemedicine; and the usage and challenges of telemedicine in developing countries. Finally, the characteristics of Information infrastructure (II) and the Actor Network Theory (ANT) have been established as a theoretical framework.

Chapter 3 describes the research setting. It begins with a brief introduction of Nepal, followed by the description of research site i.e. the Dhulikhel Hospital.

Chapter 4 covers the issues related to methods of this study. This chapter defines the research objectives and details the research design which covers the comparison between quantitative and qualitative research methodologies; and an introduction to interpretive research approach. Furthermore, it gives an account of the data collection which is followed by the reflections on methods elaborating on the issues related to access to the field, reliability on data collection tools, my role in the field and authenticity of the findings.

Chapter 5 presents the empirical findings as a case study. In this chapter, the interpreted form of qualitative data are presented emphasizing infrastructural development and the state of the art telemedicine technology at the hospital under study;

users' perspectives on the usefulness and appropriateness of the technology; and strategic plan to further sustain the telemedicine system.

Chapter 6 is the discussion which relates the research findings with the literature review chapter to answer the research questions. At first, the chapter discusses the difference of telemedicine in developing countries from the western world. After that the theoretical framework will be used to identify telemedicine as an infrastructure and the key actors involved in the network, which will be followed by discussion on appropriate strategy to develop sustainable telemedicine services in developing countries.

Chapter 7 concludes the thesis with key points from the case study and its implications.

CHAPTER 2
LITERATURE REVIEW

2. LITERATURE REVIEW

In this chapter, an overview of the definitions and types of telemedicine; and a brief history on the emergence and development of telemedicine are presented. Furthermore, the advancement of telemedicine in developing countries; its challenges and the way to proceed for successful implementation and sustainability of the services are also described. Followed by this, the aspects of Information Infrastructure (II) and Actor Network Theory (ANT) have been established as a theory.

2.1 TELEMEDICINE – DEFINITION AND TYPES

Ever since its origin and acceptance in the medical field, the term '*Telemedicine*' has been interchanged with other terms like '*Telehealth*', '*Telecare*', '*e-Health*', '*Medical Informatics*', '*Health Telematics*' or '*ICT in Health*' (Norris, 2002; NST, 2011). The meaning of these terms has also been changing from a single sentence definition i.e. "*practice of medicine at a distance*" (Wootton & Bonnardot, 2010) to broader definitions. However, telemedicine differs in specificity and the range it covers in comparison to other terms. For example, the World Health Organization (WHO) has differentiated telemedicine from telehealth as following:

"If telehealth is understood to mean the integration of telecommunications systems into the practice of protecting and promoting health, while telemedicine is the incorporation of these systems into curative medicine, then it must be acknowledged that telehealth corresponds more closely to the international activities of WHO in the field of public health. It covers education for health, public and community health, health systems development and epidemiology, whereas telemedicine is oriented more towards clinical aspect."(Antezana, 1997; Darkins & Cary, 2000)

According to Norris (2002), telemedicine is the use of information and communication technology (ICT) to transfer medical information for the delivery of clinical and educational services, whereas telehealth also includes administrative work along with the services provided by telemedicine. Similarly, he has defined telecare as the use of ICT to deliver clinical services to patients' homes.

Different organizations or authors have defined telemedicine in several ways and there is no universally accepted definition. The Norwegian Centre for Integrated Care and Telemedicine (NST) uses following definition of telemedicine:

“Telemedicine is the investigation, monitoring and management of patients and the education of patients and staff using systems which allow ready access to expert advice and patient information no matter where the patient or relevant information is located.” (NST, 2011)

American Telemedicine Association (ATA) has defined telemedicine as *“the use of medical information exchanged from one site to another via electronic communications to improve patients' health status”* (ATA, 2011).

Telemedicine has also been defined as the *“use of advanced telecommunications technologies to exchange health information and provide healthcare services across geographic, time, social and cultural barriers”* (Reid, 1996).

Also telemedicine is conceived of *“as an integrated system of healthcare delivery that employs ICT as a substitute for face-to-face contact between provider and client”* (Bashshur, 1995a).

Nevertheless, whatever may be the definition the core principle of telemedicine is common in all, i.e. the use of ICT tools to deliver healthcare services to the patients or health professionals separated by geographical barriers either in the form of medical treatment, diagnosis, administrative purpose or education.

Telemedicine can be classified either on the basis of interaction between the users or on the type of information being transmitted (Craig & Patterson, 2006). The interaction between the users can be in the form of real-time communication as in videoconferencing, so called synchronous interaction or in the form of pre-recorded interaction such as store-and-forward emailing services in which the patient's information and health condition are sent through email along with relevant pictures and the consultation is done through email. The store-and-forward method is very useful for dermatological and radiological consultation as well as other non-emergency cases, whereas synchronous interaction is more applicable in cases where face-to-face communication facilitates the consultation process. The information transmitted via telemedicine services can be in various forms such as data and text, audio, still images and video pictures.

Depending on the type of application and services, Norris (2002) has classified telemedicine into four main categories namely, teleconsultation, tele-education, telemonitoring and telesurgery. Teleconsultation supports the medical decision making process and involves two or more healthcare professionals with or without involvement of patient. Teleconsultation can be done by the use of telephone, videoconferencing or sharing of medical information like X-rays or other radiological images, pathological images, patient's medical problems etc. Tele-education is the means of gaining knowledge required for day-to-day medical practice from internet or videoconferencing etc. for healthcare professionals as well as general public and patients. Telemonitoring deals with the gathering of information related to patients' condition for the management and follow up process via use of telecommunication link like home telecare devices, videoconferencing, mobile phone alerts etc. The way of performing surgery or guiding during the surgery from distant is the main purpose of telesurgery. Telesurgery utilizes surgical robots, image guided surgery, tracking systems etc.

2.2 A BRIEF HISTORY OF TELEMEDICINE

Telemedicine has been seen as a revolution in the healthcare delivery and in the medical field (Darkins & Cary, 2000). Craig and Patterson (2006) highlighted two reasons behind using telemedicine, firstly there is no alternative to telemedicine; and secondly

telemedicine is better than existing conventional services. Telemedicine has proven to be beneficial in delivering healthcare facilities during emergencies in situation where immediate support is almost difficult such as in space, airplanes or in rural areas with undeveloped basic infrastructures. In addition, telemedicine has also reduced the cost of care since medical treatment can be made available at the site rather than requiring patients to travel to the hospital. Thus, it has helped in improving the consistency and quality of healthcare (Darkins et al., 1996).

The modern definitions of telemedicine entail the use of television, computers, radio, internet, videotapes and fax machines for the delivery of healthcare services (Darkins & Cary, 2000), but if telemedicine is simply considered as the medical activity at a distance irrespective of the communication media then the history dates behind in the Middle Ages when information about the spread of communicable diseases were communicated by the means of bells, flags or bonfires (Craig & Patterson, 2006; Darkins & Cary, 2000).

Darkins and Cary (2000) mentioned that the major milestone for the arrival of telemedicine was the invention of telephone. The main role of telephone in medical field was observed during 1910 through the transmission of amplified sounds from stethoscope (Craig & Patterson, 2006). Since then telephone has been accepted as a standard piece of medical equipment for delivering patient care services (Heagarty, 1978) and as an alternative access point to the doctors (Brown & Armstrong, 1995). Telephone has been widely used in healthcare delivery for several purposes such as receiving emergency assistance, for second opinions, scheduling healthcare activities, providing healthcare advice or monitoring the patients in remote areas (Darkins & Cary, 2000). Moreover, telephone consultation has proved to be very useful in general practice (Brown & Armstrong, 1995; Nagle, McMahon, Barbour, & Allen, 1992). A systematic review (Bunn, Byrne, & Kendall, 2004) reported that at least 50% of calls can be managed by advice through telephone and thus telephone consultation has been able to reduce General Practitioner (GP) or home visits.

The television (TV) based telemedicine system was initiated during 1960s in the United States (Bashshur, Sanders, & Shannon, 1997; Reid, 1996). In 1964, the Nebraska Psychiatric Institute started using a two-way closed circuit TV link between the institute

itself and the Norfolk State Hospital in order to provide routine distance education and teleconsultation between specialists and general practitioners (Benschotter, Wittson, & Ingham, 1965; Wittson & Benschotter, 1972). In the following year, an open heart surgery performed in United States was transmitted live to a hospital in Geneva via Comsat's Early Bird satellite (DeBakey, 1995). A two-way audiovisual microwave circuit was established at Logan International Airport of Boston in 1967 and linked to Massachusetts General Hospital for providing medical care to patients and employees at the airport 24 hours a day (Bird, 1971; Murphy & Bird, 1974).

Though the telemedicine projects had a good start, they failed to create significant role in the routine health practice at that time and slowly collapsed. The crucial reason for this was lack of funding (Myers, 2003). According to Darkins and Kary (2000), the high cost of technology, poor quality of images, lack of uptake of services and inability to interface telemedicine with mainstream healthcare provision were also the cause of failure. However, the telemedicine projects between 1974 and 1989 can be said to be remarkable landmarks in the history of telemedicine giving an opportunity to determine possible areas where telemedicine can be successful. The areas where these projects were focused include healthcare in space exploration by The National Aeronautics and Space Agency (NASA), Antarctic survey stations, offshore oil exploration industry and military healthcare (Darkins & Cary, 2000). Telemedicine in these areas flourished despite of the failures in other regions and high cost because it was the only alternative to provide medical care to people working in such situations. The U. S. Army has been providing major contribution for telemedicine development through advancement and pioneering of technology to provide healthcare to the soldiers on the front or based in remote areas (Myers, 2003). The telemetry research and development (R & D) by NASA in the manned space-flight program has facilitated for the development of current telemedicine systems (Zundel, 1996).

Later in the late 1980s and the early 1990s, there was significant rise in telemedicine usage. The main credit for this goes to the Norwegian government decision to fund 90% of the costs of care in Norway's national healthcare system and commitment to provide universal healthcare to all the citizens (Darkins & Cary, 2000). Telemedicine became the

best alternative to provide services such as otolaryngology and pathology in the remote regions of Norway, because delivering specialists services in such areas with low population density was very expensive. In addition, the specialist doctors were attracted to work in large cities which made their recruitment in remote places more difficult. Another factor for supporting the use of telemedicine at that time was the decreasing cost of technology on the one hand and availability of more robust technologies on the other. Hence, real-time videoconsultation was implemented which enabled the specialist doctors at university hospital to provide necessary suggestions and guidance to GP at remote areas via two-way audio and video connection. The teleconsultation was then readily accepted in radiology, pathology, dermatology, psychiatry, cardiology and otorhinolaryngology (*ibid*).

The Norwegian experience and success in telemedicine generated new projects in the United Kingdom (UK), the United States of America (USA), France, Canada, Australia, New Zealand, Hong Kong, Germany, Africa, Middle East and other parts of the world. (Craig & Patterson, 2006; Darkins & Cary, 2000). From then till now, telemedicine has been supporting both diagnostic and evaluative care for patients and the clinicians (Myers, 2003). The new applications are constantly being introduced and have remarkable advantages in home care and remote monitoring.

2.3 TELEMEDICINE IN DEVELOPING COUNTRIES

Telemedicine has proven to be an excellent tool for providing good quality healthcare to isolated communities as well as the source of knowledge and information exchange related to health in the industrialized countries. These advantages of telemedicine will be a virtue in the developing countries where getting access to the healthcare centre is troublesome (Wootton & Bonnardot, 2010) and thus more meaningful outcome of telemedicine can be seen on developing countries than on the developed countries (Edworthy, 2001).

Several developing or low income countries such as Kosova, India, Ecuador, Tunisia, Nepal, Bangladesh, Malaysia, South Africa, Pakistan, Uzbekistan, etc. have piloted different telemedicine services and have gained success to provide better healthcare in the rural areas. In a review of 38 articles conducted by Wotton and Bonnardot (2010), it was

found out that telemedicine has been used in the developing countries in similar ways as in industrialized countries. The study showed the primary use of telemedicine for clinical purposes and education as a distant learning tool either in the form of asynchronous (such as self study via websites) or interactive medium through videoconferencing.

Craig and Patterson (2006) have mentioned that telemedicine is being adopted globally including the developing nations and the evidence for this being the increasing number of presentations and demonstrations in conferences and meetings throughout the world. The developing nations are providing telemedicine services either through their own telemedicine network as in South Africa (Gulube & Wynchank, 2001) and Mali (Geissbuhler, et al., 2003) or via other telemedicine networks that are linked to the institutions in developed countries such as Swinfen Charitable Trust (Graham, et al., 2003; Vassallo, Hoque, et al., 2001; Vassallo, Swinfen, et al., 2001) or Medical Missions for Children (Reznik, et al., 2004).

The Swinfen Charitable Trust established in 1998 has become successful in providing healthcare advice to the isolated hospitals of developing nations through low-cost telemedicine system (Vassallo, Swinfen, et al., 2001). An email based store-and-forward telemedicine link was established at the Centre for the Rehabilitation of the Paralysed (CRP) in Bangladesh. The Trust distributed digital cameras and tripods to the CRP along with training to staffs in the use of cameras and simple email protocols. The text and image based email referrals were then sent to relevant specialists in UK and Australia via ordinary telephone lines using a 19.2 kbps (Kilobyte per second) modem. The first year study resulted in a total of 27 referrals from neurology, orthopaedics, rheumatology, renal medicine and pediatrics. Around 70% of the referrals were replied within 24 hour and the advice was proven to be beneficial in 89% of cases. The reply included advice on diagnosis, patient reassurance, referral and significant changes in management (*ibid*).

With this success, further studies were conducted with similar technology at Patan Hospital of Nepal; Gizo Hospital and Helena Goldie Hospital on New Georgia of the Solomon Islands; and LAMB Hospital of Bangladesh (*ibid*). A pilot study at Patan Hospital showed that this low-cost telemedicine system is technically feasible and has the

potential to aid for diagnosis, management and education in developing nations (Graham, et al., 2003).

As mentioned earlier, some of the developing nations have already developed their own telemedicine networks to improve primary health services and health education in the rural areas. The National Telemedicine System of South Africa has been reported to be the first of its kind in developing countries (Gulube & Wynchank, 2001). The project flourished through development of a national telemedicine strategy and guidelines for the implementation of telemedicine such as telemedicine clinical protocols; telemedicine policy guidelines on data ownership and security; and telemedicine code of ethics and professional conduct. The project was implemented in three phases over a period of five years from April 1999 to April 2004. The telemedicine applications chosen for the initial phase were teleradiology, tele-ultrasound for antenatal services, telepathology and tele-ophthalmology that were based on Integrated Service Digital Network (ISDN) connections of 256 kbps. The first year experience suggested the benefits like essential training to the healthcare providers regarding the use of ultrasound services for prenatal care; providing diagnostic and management services in complicated pregnancies; improvement in the diagnosis and management of various medical conditions as well as reduction in the professional isolation as felt by junior doctors working in community services in the rural areas (*ibid*).

Another example of the national telemedicine network in developing nation is the “Keneya Blown” project of Mali (Geissbuhler, et al., 2003). This pilot project was initiated by Mali University Medical School in Bamako in 2001 with financial support from the Geneva government and the Geneva University Hospitals. The internet based distance learning and teleconsultation services were designed based on IEEE 802.11b wireless network in Bamako and numeric telephony network in regional hospitals. The main goals of the project were development and use of internet based connections between the national and regional healthcare institutions; implementation of basic services like email and a medical Web portal; implementation of low-bandwidth internet based distance learning system; and the feasibility evaluation of long distance collaborations to sustain education and teleconsultation (*ibid*). The positive aspects and experiences from the 18

months long pilot study resulted into the RAFT project launched in 2003 involving twelve French-speaking nations of Western Africa.

2.4 CHALLENGES TO TELEMEDICINE

We know that advancement in ICT and its use in the healthcare services have facilitated in the medical field for providing quality healthcare services in remote areas or the areas where access to basic healthcare is a problem, mostly in the developing nations. Despite of some successful pilot telemedicine projects, the adoption of full phase telemedicine in routine healthcare delivery has been a challenging task (Harnett, 2004; Wootton & Bonnardot, 2010).

In a paper, Myers (2003) mentioned that the “*2001 Telemedicine Report to Congress*” had identified four major issues which might affect the use of telemedicine in the 21st century. This includes the issue of cross-state licensure; safety standards issue; issue of confidentiality and security of electronic transmission; and the infrastructural issue. The infrastructural issue mentioned as the fourth issue has been the major problem in the developing nations regarding the challenges to telemedicine.

For the telemedicine services to run successfully and sustain, the ICT tools should be well developed within the country and accessible easily. But in contrast, rural areas of many developing countries are deprived of the basic telephone networks (Martinez, et al., 2004). This “*digital divide*” within the country has been considered to be a potential problem to telemedicine development (Geissbuhler, et al., 2003) since the rural areas are the primary region where telemedicine seems to be more advantageous and productive. In addition to this, the rural areas of such countries also have limited access to electricity and transportation facilities that results in lack of appropriate maintenance, limited ability to afford expensive telecommunication infrastructure as well as poorly trained health personnel (Martinez, et al., 2004).

Above all, the cost of the technology and lack of funding has been the main hindrance to the implementation and decision making relative to telemedicine (Puskin, 2001). The lack of funding was one of the primary reasons for slower development of telemedicine at the

early stages during 1970s (Bashshur, 1995b; Myers, 2003) along with the limited development, experience and familiarity with technology; poor planning and design of the system. At that time, most of the projects were forced to cease due to scarcity of grants. Even today most of the telemedicine projects in the developing countries fail to scale up, because of this. During the pilot studies the outcomes are positive but once the funding stops, they fail to sustain which is impractical for developing countries (Wright, 1999). Thus to run a service successfully in such countries with limited resources, system design should be done with a vision of sustainability and scalability in future (Wright, 1998).

In addition, proper assessment on the effects of telemedicine on cost, quality and accessibility of healthcare should be carried out since all these three aspects are interrelated to each other (Bashshur, 1995b). This assessment is quite essential in order to trace out the potential benefits of telemedicine that overcomes the negative effects of high cost of care. The cost for ICT influences the uptake in all sectors from infrastructural development to the service level (Dzenowagis, 2009). The affordability of the technology is thus affected by the basic cost of technology and the cost relative to per capita income. For example, the cost of telephone call and high internet service can be almost two to four times expensive in developing countries than the developed countries. Due to this high cost and low income condition, the usage of such facilities will be comparatively low which is similar to the case of low usage of telemedicine system (Gulube & Wynchank, 2001). The cost-benefit analysis will therefore serve as a valid basis for policy determination so that low cost technology could be more fully and effectively utilized.

It is thus clear that following the ICT model from other countries may not work properly with respect to the developing countries (Pradhan, 2002). The author further points up that successful information system in a country can be achieved not through the technology but through the appropriate strategies for the adoption and implementation of available resources and technologies. This viewpoint highlights the need for appropriate strategies for implementation of telemedicine within a country especially in the low-resource settings where failure to sustain can result in huge loss of the national economy and therefore it can be unethical to waste huge resources in healthcare (Wootton & Bonnardot, 2010). Thus, to overcome the financial challenge and maximize the potential during and

after the implementation of telemedicine projects it will be significant to rely upon the existing infrastructures and hence progress accordingly (Harnett, 2004).

Another important point to be considered while setting up telemedicine systems is to select the site and system pragmatically depending upon the need and interest of the users (Yellowlees, 1997). Wotton and Bonnardot (2010) agree to this and suggest that very large and expensive projects should be avoided in the developing countries setting and the published experience of others should be taken into account. They further advice that close collaboration with the local doctors, national health services or NGOs working in the field should be well established so that the needs and priorities can be identified beforehand to omit the chances of failure. Accordingly, the telemedicine experience from Philippines (Marcelo, 2009) prioritized the identification of appropriate, available, accessible and culturally acceptable technologies and thereby embedded the technology into the local structure for continuation, which helped them to minimize the challenges in the healthcare.

The challenges for telemedicine rise when the service provider fails to provide appropriate training about the systems and technology to the users. Training is a critical part of successful telemedicine which should be planned and delivered at regular intervals (Vander Werf, 2004). At the initial phase, the meeting and education session for using telemedicine will help the users to get familiar with the systems in a normal healthcare environment (Yellowlees, 2006). At this stage, the users can get knowledge about equipment, operation process and check whether it is non-threatening to aid patient-related consultation that develops the confidence within them to integrate the new system in their regular work practice.

Vander Werf (2004) suggests that the training should include information on communication technology; clinical technology; diagnostic device user training for both sending and receiving sites; workflow and protocols of care and procedures for use of devices; documentation; plus trouble shooting and access to product and technical support. The author also recommends that follow-up training, on-site assessment and additional training to compensate staff turnover should also be planned timely.

Apart from this, Yellowlees (1997) recommends that the telemedicine system must be owned by the users themselves, so that they can be involved in all the stages of planning, implementation and evaluation. In order to support the telemedicine system within a country, it is essential to set up a National Telemedicine Committee that includes healthcare professionals and ICT specialists for the preparation of vision and program for the introduction of telemedicine within the national health policy framework (Trichili, Dhibi, & Solaiman, 2008). By doing so, it will be easy to choose user-friendly technology which is one of the important criteria for successful development of telemedicine (Yellowlees, 1997). The user-friendly technology will thereby provide the users an opportunity to be acquainted with it, trace out the appropriate evidence for benefits and support in further development and evaluation.

Looking at these challenges to telemedicine, it seems that appropriate strategy should be made to continuously run the system in regular work practice. The right strategy to follow for the developing countries would be to build up intra-country telemedicine networks that rely on within-country resources (Wootton, 2008). Wotton and Bonnardot (2010) have mentioned that optimum way to proceed would be starting with small projects; simultaneously building evaluation into the pilot stage; and thereby scaling up on the basis of clear success. However, the project should start with a well established vision and a long term financial plan to avoid any chances of failure (Vander Werf, 2004).

The principal driving forces for telehealth have been financial, specialist clinical interest and proof of technological feasibility (Jennett et al., 2003) therefore, the evaluation of the telemedicine system at frequent intervals is equally important to determine the usefulness of the system and check whether the potential demand has been fulfilled or not. The evaluation should look at the effectiveness of telemedicine implementation by accessing whether or not defined outcome measures have been achieved within a reasonable time-frame and with the input of appropriate resources (Yellowlees, 2006). The evaluation process should also identify the improved skills in users and the health outcome measures relevant to the remote communities along with the improvements for patients (Yellowlees, 1997).

These purposes of telemedicine on the healthcare can be fulfilled by the appropriate use of technology and procedures i.e. protocols and guidelines. Moreover, telemedicine should be considered as a tool complimenting the current healthcare system of the country rather than an alternative to face-to-face medical practice (Gulube & Wynchank, 2001).

2.5 CHARACTERISTICS OF INFORMATION INFRASTRUCTURE (II)

The traditional Information System (IS) is designed with a specific purpose which develops within a hierarchical structure (Hanseth & Monteiro, 1998). The IS develops as a single component within organizational boundaries, i.e. it is assumed to be closed systems having central control. These characteristics limit the use of IS in a broader perspective. They fit well in a small organization but they fail in large heterogeneous organizations where several components are interdependent upon each other and in such cases defining the boundaries become more difficult. The systems in these large organizations fail to have complete control since they are open to a wide range of actors forming a socio-technical network. Because of these limitations of the IS, the concept of Information Infrastructure (II) is mostly used for heterogeneous systems.

The telemedicine examples from developing countries mentioned in the above sections indicate that telemedicine is not an information system; rather it is a wide network. For instance, the telemedicine service provided by Swinfen Charitable Trust is a global network where doctors from different professional backgrounds and countries respond to the medical problems from the developing countries. In addition the use of store-and-forward telemedicine link has established a basis for medical education in such countries. Similarly, the national telemedicine network of South Africa or Mali did not just focus on the technology but also developed guidelines and protocols to run the system continuously as well as resulted into the expansion of projects. All these factors suggest that telemedicine is a socio-technical network which constitutes an infrastructure.

The term “Infrastructure” has been considered to be a substrate that is initially built and maintained but remains invisible and upon which something else runs or operates (Star & Ruhleder, 1996). An infrastructure becomes transparent when the large-scale technology brings solution for the local and global variations in practices which can then be used in a

natural and easier way. Hanseth and Monteiro (1998) relates the term “infrastructure” to be used with the information technology (IT) in order to represent basic support systems that include operating systems, file servers, communication protocols, printers etc. The term infrastructure separates such support systems from the applications using them, as the complexity of computing rises in an organization.

Since an infrastructure is more than the individual components, the successful development and implementation of information infrastructures is not just limited to traditional approaches and strategies for development of telecommunications solutions and information systems (IS). II is more than IS, in the sense that IIs are large integrated systems that have broader purpose unlike IS, which is a single individual component with a clear purpose. Also IIs have no organizational boundaries that can start and terminate at any point. In addition IIs have evolutionary development with lack of complete control (Hanseth & Monteiro, 1998).

Bowker and Star (1999) mentions II as tricky thing to analyze. Information infrastructures are never transparent to everyone and their work-ability becomes increasingly complex as they scale up. Though IIs are easier to use, they are hard to see. Also the bigger they are, hard is to visualize them. A deeper understanding of the II can be achieved through methodological attention to the architecture and use of these systems.

Hanseth and Monteiro (1998) describe the following characteristics of IIs:

- i. *Enabling*: IIs have enabling or supporting functions because it is designed to fulfill a wide range of activities and is supposed to create new area for different activities and not just simply improving the existing one.
- ii. *Shared*: IIs are shared by a larger community and is not limited for a specific use only. The elements of the system are interdependent and the change in one brings change in the whole system which defines that IIs are shared standards.
- iii. *Open*: Since IIs have no beginning or termination point, there is no limit for determining the number of actors to be involved in the system which shows that IIs are always open.

- iv. *Socio-technical networks*: IIs cover a wide range including both technological components as well as social components i.e. humans, organizations and institutions. It cannot work properly without support of people which means that the users are key factors for implementation of IIs and is more than just a pure technology.
- v. *Heterogeneous*: Since IIs have a broad socio-technical network, it is heterogeneous. All these components are interrelated and develop ecologies of networks. So the IIs are layered, links logical related networks and integrates independent components to make them interdependent.
- vi. *Installed base*: New infrastructures always develop from an already existing and continuously evolving infrastructure, so called an installed base. The infrastructure never develops from a scratch rather it is an integration of the installed base into the new system or technology. To develop a large infrastructure takes time and as time passes by the requirements increases which tend to modify the already existing infrastructure to develop a new one. Bowker and Star (1999) also agrees with the installed base characteristic of the IIs.

“Infrastructure does not grow de novo; it wrestles with the inertia of the installed base and inherits strengths and limitations from that base”
(Bowker & Star, 1999)

2.6 THE ACTOR NETWORK THEORY (ANT)

The emergence of information infrastructure can be analyzed by the use of Actor Network Theory (ANT). This theory was initially developed by Michel Callon and Bruno Latour at École des mines in Paris. The ANT is a social science approach to investigate social and technical aspects that include people, organizations and technology put together in a network (Monteiro, 2000; Walsham, 1997). A key feature of this theory is that the actors include both human and non-human factors and are treated in same way and so called a *hybrid collectif* (Aanestad & Hanseth, 2000; Callon & Law, 1995; Latour, 1991;

Walsham, 1997). These actors are together called as “actants” in order to represent a hybrid network for an infrastructure. The actants and their network are interrelated which cannot work properly without each other and thus seems to be heterogeneous.

Being a heterogeneous system, it is obvious that telemedicine infrastructure contains various social and technical actors that play specific role within the network. Developing a well established telemedicine infrastructure is not an easy task. This requires identification of probable actors that directly or indirectly affect the continuation of the system. For example, the challenges of telemedicine recommend that a proper strategy is necessary to sustain the services. Therefore, who to involve in this strategy development process and what factors influence the negotiation process should be well known beforehand. The ANT thereby helps to identify the key actors involved in the network as well as explains the necessary elements required for developing a stable infrastructure.

The actor-network theory can be used both as a theory and methodology. It provides the theoretical concept of viewing the elements of the real world as well as highlights the need of these elements in empirical work (Walsham, 1997).

Translation and inscription are two major concepts for the ANT (Monteiro, 2000). The translation is a process of negotiating the interests of actors to create a network thereby coming to a single need. Each and every actor in the network might have their own requirements, needs, interests, expectations and the way of looking into the problem; so they need to agree to a common solution for the problem that meets all their needs. Thus, translation can be seen as a process of aligning each actants’ interests to make a stable network (*ibid*). Therefore, while developing a groupware it is necessary to know each user’s interests, needs and role; so that the system can be developed to cover the entire essential needs and implemented without affecting their regular work practice. Negotiations of these interests will help the institution to develop strategies required for inscription of the negotiated interest into technology as well as the way to implement the new system in the heterogeneous work practices.

Inscription is another important concept of ANT. It refers to the way technical artifacts embody the patterns of use (*ibid*). The actor in the network behaves in a certain way but

has presumptions about other actors also, which is called inscription. The inscriptions can be like a script, scenario or programs of actions (Latour, 1991). These programs of actions when inscribed into technology represent the technology as an actor in the network that is supposed to fulfill the human actors' needs. Thus, technology itself can be seen as an actor within the network.

The transcription and inscription process depends on identification of needs of different actors; negotiation of these needs and its inscription into technology; the actor responsible for inscription; and the strengths of these inscriptions (Monteiro, 2000). The success of the new technology so developed is thus not only dependent upon the technology but also the users and the organizational body involved in its implementation.

In order to design successful information systems in medical field, it is essential to understand the work practices where the system is supposed to be implemented (Berg & Goorman, 1999) because of the difficulty in implementation of comprehensive information systems in healthcare organizations (Berg, 2001). Healthcare services include actors from different professional backgrounds, interests and problems; such as doctors, nurses, health assistants, non-medical staffs and patients. Thus simply installing and using a new technology to provide better healthcare facilities will not always be successful (Berg, 1999). The way of coping with the clinical problems may vary from one professional to another. The technology professional may feel that the system they have developed works best in any working condition but at the same time the healthcare workers who are the end-users may not find it suitable for their work practices, and which can be the foremost reason for the failure of the system to continue. It is therefore necessary to identify the key actors (both social and technical) and their influence in overall system. It is worthwhile for the institution to involve the end-users during the system development. The system developed through user participation follows step by step so that the changes in technology and work practices can evolve together. This will have a tendency to establish an organized network between the human and the non-human actors. The user participation allows the users to provide their needs and interests to the system developers as well as the users will have a better understanding of the functionality and limitations of the system (Johannesen & Ellingsen, 2008).

CHAPTER 3
THE RESEARCH SETTING

3. THE RESEARCH SETTING

In this chapter, background information of the research setting has been presented. It begins with short introduction on the country profile of Nepal and includes information on geography; population; economy; education status; telecommunication usage and health system. It is followed by the description of the hospital where the field study was conducted.

3.1 COUNTRY PROFILE – NEPAL

3.1.1 Geographical Information and Administrative Divisions



Figure 1: Administrative Division of Nepal ¹

¹ Available from: <http://www.holidaynepal.com/sitemap.html> [Retrieved Oct 13, 2010]

Nepal is situated in Southern Asia at the latitude of 26°22' North to 30°27' North and the longitude of 80°04' East to 88°12' East. It is bordered by China in North and India in East, West and South. The total area of Nepal is 147,181 sq. km. stretching from east to west with mean length of 885 km. and widening from north to south with mean breadth of 193 km. and is divided geographically into three regions namely, mountain, hill and terai.

Nepal is a landlocked country occupying about 0.03% and 0.3% of total land area of the world and Asia respectively (CBS, 2008). It has a varying altitude from 70 meters to 8,848 meters, i.e. of Mt. Everest, which is the highest peak in the world. The upper Himalayan region has unbroken mountain range which contains eight peaks higher than 8,000 meters. The middle Hill region is surrounded by gorgeous mountains, high peaks, hills, valleys and lakes, whereas the Terai region is almost flat lowland consisting of dense forest, national parks, wildlife reserves, conservation areas and cultivable lands (*ibid*).

For the equal development throughout the country, administratively Nepal is divided into 5 development regions consisting of 14 zones and 75 districts as shown in Figure 2. The districts are further divided into small units, i.e. Village Development Committees (VDCs) in rural areas and Municipalities in urban areas. There are a total of 3915 VDCs and 58 Municipalities throughout the country.

3.1.2 Population and Demographic Information

The total population of Nepal as of Mid-2009 has been reported to be around 27,504,000 and has been estimated to reach around 35,662,000 by Mid-2025 (UNFPA, 2010). The annual population growth rate has been estimated to be around 1.419% in the year 2010 with about 36.6%, 59.2% and 4.2% of total population in the age group of 0-14 years, 15-64 years and 65 years and over respectively and male to female ratio of 0.96 in the total population (CIA, 2010).

3.1.3 Economic Status

Nepal is one of the poorest and least developed countries in the world with around 78% of people living below US \$2 per day (CIA, 2010; UNFPA, 2010). The Gross Domestic

Product (GDP) was US \$13406 million during 2008 (UNData, 2010). Agriculture is the main occupation of the major population accounting for one-third of GDP (CIA, 2010). Around 46% of the total population was unemployed during 2008.

3.1.4 Education Status

According to Central Bureau of Statistics (CBS) (2008), the total literacy rate of Nepal in the year 2001 was 54.1%. The literacy rate for male and female was 65.5% and 42.8% respectively. The government expenditure on education was around 3.8% of GDP in 2008 (UNData, 2010).

3.1.5 Telecommunication Usage

The users of telecommunication services have been increasing every year in Nepal. The network coverage is not constant throughout the country because of the geographical variances. It has been reported that 805,100 main telephone lines were in use during 2008 and there were around 4.2 million mobile users (CIA, 2010). The internet users have also been increased since 2000 from 0.2 users per 100 inhabitants to 1.7 users per 100 inhabitants in 2008 (UNData, 2010).

3.1.6 Health System and Status

The Ministry of Health and Population (MoHP) has a separate department called Department of Health Services (DoHS) to deliver preventive, promotive and curative health services throughout Nepal (MoHP, 2009a; WHO, 2010a). Under DoHS, there are several divisions to look after the health services in different levels. The central level comprises of the Health Divisions, Centers and Central Hospitals.

In the rural areas, i.e. at the VDC level, there are Primary Health Care Centre (PHC-C), Health Centre (HC), Health Post (HP) or Sub-Health Post (SHP). The HP and SHP are the basic units of the health system in Nepal and SHPs are the first contact point for basic health services (Rai, Rai, Hirai, Abe, & Ohno, 2001; WHO, 2010a). At the district level, there is a District Hospital with limited number of beds and all of the HC, PHC-C, HP and

SHP including the District Hospital comes under the control of District Health Office (DHO).

Above the district level is the Zonal Level with a Zonal Hospital having certain specialties in comparison to District Hospitals. Each of the five development regions has a Regional Health Directorate under which all the health units at Zonal and District Level are managed (*ibid*). Table 1 shows the facilities and human resources in health under MoHP in Nepal.

Table 1: Health Facilities and Resources under MoHP

Health Institutions	Hospitals (Central, Regional, Sub-regional, Zonal and District)	94
	Health Center	5
	Primary Health Center	201
	Health Post	699
	Sub-Health Post	3,104
	Ayurvedic Health Institution	293
Health Manpower	Doctors	1,457
	Nurse / Auxiliary Nursing Mother (ANM)	11,637
	Paramedic / Health Assistant (HA)	7,491
	Village Health Worker	3,190
	Maternal and Child Health Worker (MCHW)	3,985
	Ayurvedic Physician	394
	Baidhya	360

Source: (MoHP, 2009b)

Besides the government hospitals, there are about 74 private sector hospitals and nursing homes, 3 community-run hospitals, 16 eye hospitals and 12 hospitals run by Non-Government Organizations (NGOs). The government has 2 teaching hospitals whereas 9 teaching hospitals are managed by private sectors (MoHP, 2009b). There are a total of 9,881 hospital beds including both government and private sectors.

Nepal does not have insurance system for medical treatment. All the treatment and medication should be financed privately by the patient party. The top 10 causes of death in all ages during 2002 in Nepal as reported by World Health Organization (WHO, 2006) were perinatal conditions, lower respiratory infections, ischaemic heart disease, diarrhoeal diseases, cerebrovascular diseases, chronic obstructive pulmonary disease, hypertensive heart disease, tuberculosis, measles and road traffic accidents. The key indicators of health are presented in table below.

Table 2: Health Indicators in Nepal

HEALTH INDICATORS	YEAR	VALUE
Life expectance at birth (in years)	2008	63
Birth rate (annual number of births per 1,000 total population)	2010 (estimated)	22.43
Death rate (annual number of births per 1,000 total population)	2010 (estimated)	6.89
Lifetime risk of maternal death – 1 woman in:	2008	31
Neonatal mortality rate (per 1,000 live births)	2008	31
Infant mortality rate (probability of dying by age 1 per 1,000 live births)	2008	41
Under-five mortality rate (probability of dying by age 5 per 1,000 live births)	2008	51
Adult mortality rate (probability of dying between 15 and 60 years per 1,000 population)	2008	277
Prevalence of tuberculosis (per 1,000 population)	2008	170 [71-300]
Prevalence of HIV among adults aged 15-49 years (in %)	2007	0.5

Source: (CIA, 2010; UNFPA, 2010; WHO, 2010b)

3.2 “DHULIKHEL HOSPITAL” – THE RESEARCH SITE

Dhulikhel Hospital was established in 1996 as a result of joint initiative by Dhulikhel Health Service Association, Dhulikhel Municipality and NepaliMed. It is an independent, not for profit, non-government institution and has been well supported by the community as a quality health services provider. The hospital is located in Dhulikhel Municipality of Kavre district, at about 30 km Northeast of Kathmandu, the capital of Nepal.



Figure 2: View of Dhulikhel Hospital

The hospital is involved in a range of activities from basic community health at the grass roots level to the services of a modern teaching hospital and including basic research facilities. Dhulikhel Hospital is also the university hospital for all the medical programs run under the collaboration with Kathmandu University.

Dhulikhel Hospital provides healthcare services at minimal cost through well trained staff in both inpatient and outpatient departments. The hospital has well equipped general ward,

Intensive Care Unit (ICU), Coronary Care Unit (CCU), Neonatal Intensive Care Unit (NICU), Paediatric Intensive Care Unit (PICU) including investigative and therapeutic services.

The hospital covers the population of approximately 1.9 million people from Kavrepalanchowk, Sindhupalchowk, Dolakha, Sindhuli, Ramechhap, Bhaktapur and other surrounding districts. Moreover, services have been provided to people from more than 60 districts of the country. In 2009, around 180,995 individual patients had accessed healthcare services from the hospital.

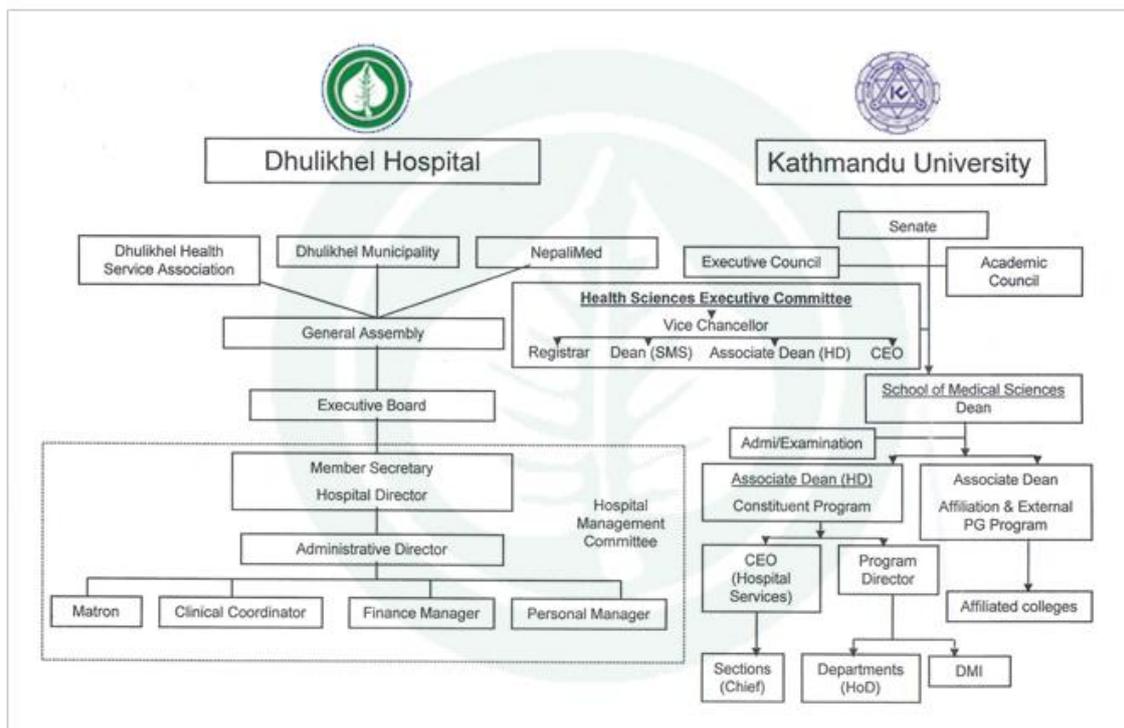


Figure 3: Organogram of Dhulikhel Hospital ²

The 'Annual Report 2009' published by the hospital reports that there are 128 doctors (includes specialists, faculty members and medical officers); 221 nursing and paramedical staffs; and 153 administrative and support staffs.

² Available from: <http://dhulikhelhospital.org/aboutus/index.php?obj=administration> [Retrieved Nov 21, 2010]

Apart from the therapeutic and diagnostic services within the hospital, different community based activities are also run in order to address the health issues in rural areas through Department for Community Programmes. The hospital is running 12 outreach centres at rural areas of different parts of Nepal. These centres not only function as the provider for basic healthcare services in those areas but also function as a platform to provide various preventive, curative and rehabilitative services to the community. The residential paramedic staffs provide 24 hours services in these centres. Frequent visits at regular intervals are made to these centres by a team of doctors (including various specialists) and other staffs from community department. Public health and micro-finance programs are also run from these outreach centres.

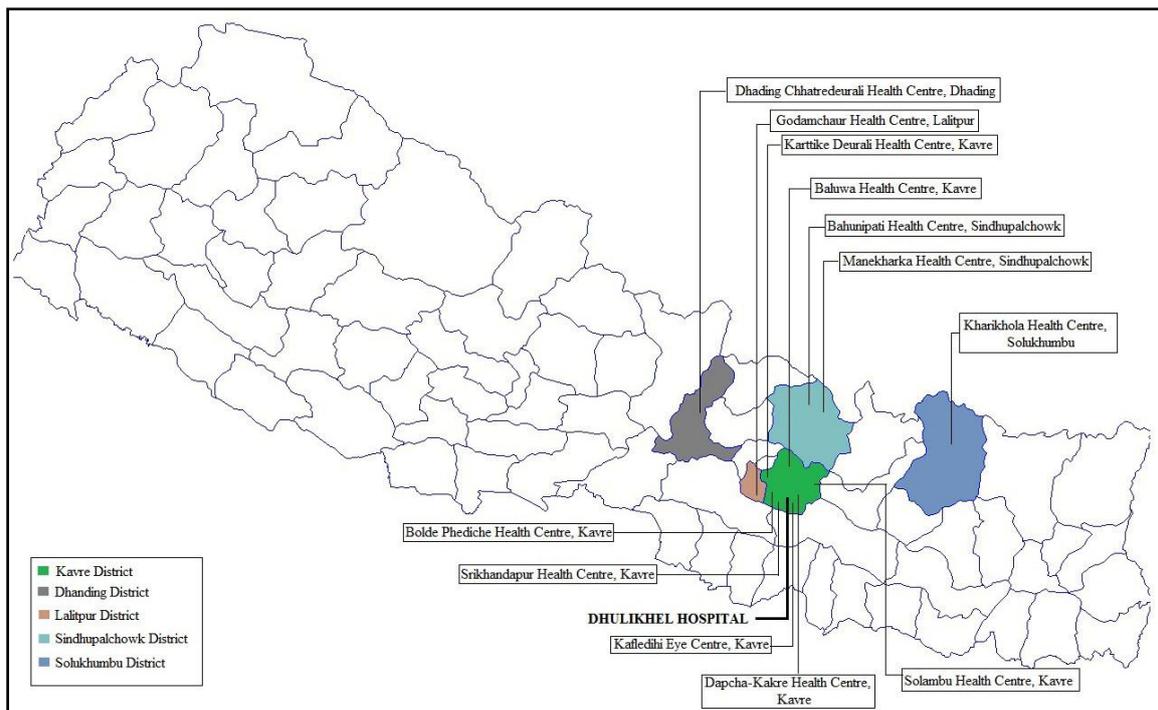


Figure 4: Geographical Location of Outreach Centres

CHAPTER 4
METHOD

4. METHOD

This chapter covers the methodological issues regarding this study. At first, I will present the research approach which includes the objectives of the study; comparison of quantitative and qualitative research methods with major focus on interpretive case study; and brief description of the site for data collection. Followed by this, I will describe how empirical data were collected and finally reflections on the research method and my experiences in the field will be discussed.

4.1 RESEARCH APPROACH

4.1.1 Research Objectives

The main objectives of this study are to explore the infrastructural development of telemedicine, its usage, benefits and users' perspectives on the stability and sustainability of the services in future with context to hospitals in Nepal. Therefore, this thesis will respond to the following research questions:

- i. How can widespread use of telemedicine be achieved in regular health practice?
- ii. What strategies should be followed to maintain sustainability?
- iii. What is the state of telemedicine infrastructure at hospitals in Nepal?
- iv. Why telemedicine services have become a need in rural health centres?
- v. What are the different interests and expectations of health professionals regarding telemedicine services?
- vi. How should socio-technical actors cooperate for successful teleconsultation?

4.1.2 Research Design

4.1.2.1 Qualitative versus Quantitative Methodology

A research study can be designed in two ways namely “qualitative” and “quantitative”, which has been classified by Robson (2002) as “flexible” and “fixed” designs respectively. As the name “quantitative” itself refers to quantity or number, this research method is mostly suitable for determining the size, extent or duration of certain phenomena or to find out the pre-specified effect of an intervention or specific cause (Stoop & Berg, 2003). It is mostly done in the form of experiments and surveys with close-ended questionnaires and the data so collected are evaluated statistically (Robson, 2002). For conducting such type of research, a well developed conceptual framework or theory is required in advance to know ‘*what to look for*’, ‘*what you are going to do*’ and ‘*how to do it*’ as well as an extensive pilot work is required to find out the feasibility of the method.

Quantitative research mostly begins with the selection of hypothesis that can be proven to be true or false statistically, and such method is suitable for the measurement or analysis of causal relationship between variables. Randomized controlled trial (RCT) is considered to be the ‘gold standard’ in the quantitative research (Robson, 2002), as well as standard approach in evaluation of Patient Care Information System (PCIS) (Stoop & Berg, 2003). One of the advantages of fixed design is that, the result can be generalized from the sample to the whole population under study. However, achieving success by using such a method in the real world setting can be difficult since it requires the researcher to have a particular degree of control that is not possible in all cases (Robson, 2002), like in case of understanding different people interpretation of a certain situation or work practice where sometimes the researcher has to change his interview questionnaires to know more detail about the situation. This research method can be related to positivism, as the method is widely used for hypothesis testing, analyzing quantifiable measures of variables and generalizing the result to the whole population based on the objective knowledge or facts from the scientific theory (Orlikowski & Baroudi, 1991; Robson, 2002), which limits to capture or interpret the real meaning of social behavior in real world research.

As we know that, research in Information System (IS) is more likely to be a real world setting where different human and non-human actors are interdependent upon each other to form a heterogeneous network (Monteiro, 2000). These types of work setting have open systems where the human actors might have different perceptions of the social behavior and whole network. So, flexible designs or qualitative research are more suitable than the quantitative research for such settings with people having their own perceptions and interests (Robson, 2002).

In contrast to quantitative methods, the data in qualitative research are in the form of words, but can also be presented in quantitative form. For instance, the data collected qualitatively can be grouped in together accordance to the similarity of statements and therefore analyzed quantitatively by presenting the number of informants agreeing to the respective statement.

The data collection in qualitative methodology has much less pre-specification and the design evolves, develops and unfolds as the research proceeds and thus said to be flexible design (Robson, 2002). The methods used to collect data in qualitative research include interviews, participant observations and document analysis in the form of case studies, ethnographic studies and grounded theory studies to give details of *what*, *why* and *how* of a social phenomena (Kaplan & Maxwell, 1994; Robson, 2002; Stoop & Berg, 2003). These data collection methods help to understand the phenomenon from the points of view of the participants and in particular social and institutional context (Kaplan & Maxwell, 1994).

4.1.2.2 *The Interpretive Research Approach*

Qualitative research can be done with a positivist, interpretive or critical stance (Klein & Myers, 1999). In opposition to positivist as mentioned above, interpretive research in IS assumes that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools and other artifacts (*ibid*). In interpretive research, there are no predefined dependent or independent variables, but focuses on the complexity of human sense making as the situation emerges (Kaplan & Maxwell, 1994). It also attempts to understand the phenomena through the meanings that

people assign to them (Boland, 1985, 1991; Deetz, 1996; Orlikowski & Baroudi, 1991). As mentioned by Klein and Myers (1991), interpretive methods in IS are

“aimed at producing an understanding of the context of the information system and the process whereby the information system influences and is influenced by context” (Walsham, 1993).

The interpretive field studies can be done by either in-depth case studies or ethnographic studies. The major difference between these two is that ethnographic study requires long periods in the field and the researcher should have detailed and observational evidence, whereas case studies are a form of enquiry that does not depend upon ethnographic or participant-observer data (Klein & Myers, 1999). In IS research it is important to understand human thought and action in social and organizational contexts (*ibid*). This is because different individuals have different perspective to interpret their work practice and the performance of the systems. So, interpretive method is suitable for such research settings, since this method has the potential to produce deep insights into the information systems phenomena including management and development of information systems (*ibid*). Ethnography provides detail insight into the concepts and premises to understand the real world social processes in depth (Forsythe, 1999).

4.1.2.3 Validation and Evaluation of Interpretive Research

Despite of the wide use of interpretive method for IS researches, there has been several criticism on the validation of the result as well as on evaluation of the quality of research. To overcome this, Klein and Myers (1999) have proposed a set of guidelines with 7 principles based on anthropology, phenomenology and hermeneutics to conduct interpretive research. The principles are based on the fundamental principle of hermeneutic circle that has been argued by the authors to be relevant in all interpretive work. The idea behind hermeneutic circle is that

“we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships” (*ibid*)

The first principle is that of the hermeneutic circle which as stated above means that the individual understandings should be transformed from the whole to the parts and back to the whole (Klein & Myers, 1999). This further suggests that the interaction between researchers and participants pre-understanding results into a complex whole of shared meanings. The second principle, i.e. the principle of contextualization reveals that it is important to set the subject matter according to its social and historical context so that the condition of emergence of current situation under investigation can be made transparent to the intended audience. The ethnographer has to face a multiplicity of complex conceptual structures which are superimposed or knotted into one another so called “thick description” (Geertz, 1973), thus it is very important for him to have some background information of the research setting.

The third principle highlights the interaction between the researchers and the subjects. In interpretive research, the participants are themselves interpreter like the researchers and also the researchers should be part of the network to get a deep insight of the settings. This interaction between the researcher and the subjects reflects the social construction of research data (Klein & Myers, 1999). The ethnographers treat participants’ views as data and not as result (Forsythe, 1999), so that they can interpret the findings from the field with their own background knowledge and experience. Since the researcher interprets the interpretation of the participants it is an advantage for him to have the background on the same field. This will help him/her to understand the situation more deeply and thus can handle the data so collected to give a proper conclusion to the study.

The abstraction and generalization of the outcome of the interpretive research is bit tedious job, since the interpretations of different individuals may differ. In this case, social theories like structuration theory or actor network theory play a crucial role which is reflected by the fourth principle (Klein & Myers, 1999). Though positivist research also use theory to generalize the result, the difference in this case is that interpretive researchers never falsifies the theory but instead applies it as a sensitizing device to give their research a particular direction. The theory in interpretive research can be used in three ways, as an initial guide to design and data collection; as part of an iterative process of data collection and analysis and as a final product of the research (Walsham, 1995). The

use of theory in the earlier stage of interpretive study helps the researcher to create an initial theoretical framework based upon his prior knowledge and background and thus helps to create a sensible theoretical guideline to support the empirical work (*ibid*). Theory also plays a major role in the real world research, in addition to generalize the data collected from the field, it also helps to view the world in a certain way and thus distinguishes interpretive research from anecdotes (Klein & Myers, 1999).

The fifth principle clarifies that sometimes the interpretive researchers need to criticize their preconceptions if incase the research finding contradicts with that of the preconceptions. The sixth or the principle of multiple interpretation states that the interpretive researchers should be able to highlight differences in participants' perspective and interpretations as far as possible and the final principle, i.e. the principle of suspicion requires sensitivity to possible biases and systematic distortions in the narratives collected from the participants (Klein & Myers, 1999). In interpretive studies, it is quite often that sometimes the participants present 'false claims' (Walsham, 1995). The researcher should be capable of distinguishing these false claims and try to find out the correct information by looking at the information presented as 'thick descriptions' from different critical perspectives and focusing on the multiple interpretations.

Though these principles help the interpretive researcher to conduct the research in a best possible way, but it is not necessary that all these principles be applicable for all interpretive researches as shown in examples by Klein and Myers (1999).

4.1.2.4 Role of Researcher

In addition to following specific guidelines for the methodology, the most important part in any research whether it is quantitative or qualitative is the role of researcher in the field. Since the quantitative study is based on pre-formulated research instruments and other data collection tools, it is less researcher-dependent and thus assumes that the researcher has a value-neutral instance (Borland, 2001; Orlikowski & Baroudi, 1991), whereas, in interpretive research, the researcher is viewed as 'the key instrument' one which is "calibrated" first through training in theory and methodology and then through experience (Forsythe, 1999).

Since the researchers are the primary instruments in interpretive studies, the role of researcher is crucial for research design; data collection and management; data analysis and interpretation; and reporting processes to make the outcome of the study trustworthy (Borland, 2001). The factors influencing the role of researcher include his/her background and personal qualities; degree of neutrality and involvement; relationships with the informants as well with the organization.

Having background knowledge in the field of research is an additional benefit for a researcher. It helps him to find out the right participants as well as less time might be required to know the work practice or settings of the organization under study. The researcher should have an open and enquiring mind, be a good listener, be flexible and adaptive, and be able to grasp the issues as well as be devoid of bias (Robson, 2002). The researcher ought to be proficient in grasping the issues and interpreting them during the study so that any evidence, clues, etc. don't get missed or misinterpreted later, and have to be open to contrary findings in order to avoid bias. The researcher must acquire good communication skills and thus present oneself as a reasonable, courteous and unthreatening human being by cordially interacting with the subjects, and show interests in what people do and what they have to say while tolerating long periods of boredom (Randall, Harper, & Rouncefield, 2008).

The researcher can be classified as either an insider or an outsider depending upon his/her relationship with the subjects and the organization (Walsham, 1995). The 'outsider' researchers remain at more physical and emotional distance from the subjects and thus the subjects feel free to express themselves as the trust builds up and there is less chance of 'going native' (Randall, et al., 2008). This is the advantage of being an outsider since the researcher has no direct personal stake in various interpretation and outcomes of the study (Walsham, 1995). Apart from this, the disadvantage of being an outsider is that the presence at each and every site or on every occasion as well as access to information that are confidential or sensitive is not always possible and thus it is difficult to grasp and understand the direct sense of the field organization from the inside in such cases (*ibid*).

The 'insider' researchers are those individuals who play a role as participant observers or action researchers and are involved within the research setting like a member of the

organization even though it is temporary for a short period of time. The advantage of an insider is that the researcher can have the inside view of the field of study, has more access to confidential and sensitive issues and be more flexible than being an outsider (*ibid*). In addition to this, when the time and cost comes into consideration, being an insider is more advantageous than the outsider (Randall, et al., 2008) because insider researcher require less time to understand the setting and get access to the field. The limitation of being an insider is that the subjects may feel that the researcher is having a direct personal stake on their matters and thus may feel awkward to freely express their views (Walsham, 1995). Also the insiders tend to experience their own assumptions as obvious truths given that even the insider will know only a limited amount of information about the field under study and that some sacred 'religious' places may still be hidden (Forsythe, 1999; Randall, et al., 2008).

The choice of role for the researcher should depend upon the advantages and limitations for specific role in the study, but the best researcher is one who is an outsider with considerable inside experience (Forsythe, 1999). This is because, in the interpretive study the researcher has to perform a difficult task of interpreting participants' descriptions by his own conceptual apparatus (Walsham, 1995) and the outsider researcher having inside experience of the organization or the field can extract and interpret or evaluate the data through systematic comparison between inside and outside views of particular events and processes (Forsythe, 1999).

As we know that, the result of the interpretive research is in the form of words or texts, it is most important that these descriptions should be convincing to the readers. The researcher should therefore focus on the accountability of the research by stressing on authenticity, plausibility and criticality of the texts (Golden-Biddle & Locke, 1993). Authenticity gives an account of the researcher's presence in the field, including relationships and interactions with the subjects upon which meanings, ideas and concepts are constructed. Plausibility makes an effort to contribute that the findings of the research are indeed worthy, generates theory and that the outcomes are influential. Criticality provides a mirror to look into and re-examine taken-into-granted assumptions that underlie in normal work situation, including behaviors and context.

Though many technical people think that ethnography requires no particular experience, this does not mean that any person without training, knowledge or skills can do it. As mentioned by Forsythe (1999), ethnography is not “*just a matter of common sense*”, because the excellence of the research depends on the quality of researcher as an interviewer, observer, facilitator and interpreter of data (Borland, 2001).

4.2 DATA COLLECTION

The field study has been conducted at Dhulikhel Hospital, also called as the Kathmandu University Teaching Hospital. The detail of the research site has been described in “*Section – 3.2*”. Teleconsultation as described in this study is done between the paramedics at the outreach centres with consultant doctors at the hospital.

In order to meet the research objectives of this study, a qualitative method with interpretive research approach (Klein & Myers, 1999; Walsham, 1995, 2006) was followed. The empirical data that form the basis of this thesis were collected during July 2010 – September 2010 from the doctors, paramedics and staffs of Emergency Department; Department of Obstetrics and Gynecology; Department of Dermatology and Venerology; Department for Community Programmes and outreach centres of the Dhulikhel Hospital. The paramedics in this study represent the health workforce such as health assistants and nurses working in the remote areas i.e. the outreach centres. During this time period I visited two outreach centres, viz. Bahunipati Health Centre and Bolde Phediche Health Centre. The primary research approaches were emailing, informal discussions and observation followed by semi-structured interviews and document analysis.

Initially, I established email communications with one of the project members during March 2010 in order to know about the telemedicine related work at the hospital. In response, he shared his experience about the ongoing telemedicine services and its challenges. In due course, I also obtained the name of prospective persons at the hospital with whom I could ask permission to get formal approval for my field study.

After receiving the approval from the Chief of Department for Community Programmes, I felt that I must have thorough information about the hospital departments, organization, work practice and staffs; which were very essential for me to understand the research setting and find out the starting point for field work. So, I started to collect as much information as possible through informal discussions with staffs from the Department for Community Programmes. For the first few weeks, I spent most of the time with the department staffs discussing about the development and current situation of telemedicine; different medical cases solved through it; users involved in the consultation and challenges to telemedicine that has been experienced. Sometimes, the staffs used to ask me to join them for lunch at the canteen, which helped me to be familiar with staffs and doctors from other departments as well. I always carried a diary to note down important points during discussion which were transcribed later the same day.

I was also advised to visit the outreach centres to observe the telemedicine infrastructures and understand the scenario of the remote areas. The Department for Community Programmes organize regular visit plans to these outreach centres along with the medical team from different departments. As per the schedule, I visited Bolde Phediche Health Centre and observed the available infrastructures for telemedicine. I took pictures of the technologies and setup with my digital camera. At the outreach centre, I was able to conduct a short interview with the health assistant, though I was not fully prepared for it. My queries were focused on the applicability of the technology for consultation; doctors' and patients' response from teleconsultation; hindrances during the consultation; his experience, expectations and suggestions regarding way to proceed for betterment of the teleconsultation. I was not able to record the interview because of some technical problems with my digital voice recorder; however, I made notes on what he explained in my diary. Writing down the whole conversation was very difficult, so I had to request him to slow down from time to time. Transcriptions of the notes were done later on the same day after returning back from the outreach centre.

The analysis of the transcriptions from informal discussions as well as observation and interview at the outreach centre helped me to formulate background information on the research setting and thus further proceed in data collection process. After having detail

background information, I was able to identify the key informants for my study and thus design the questionnaires for interview. An interview guide (Appendix 1) was formulated to support my research questions. The questionnaires were open-ended in nature, so that the informants could provide as much information on the subject matter.

Table 3: Key Informants for Interviews

KEY INFORMANTS	WORK STATION	TOTAL LENGTH OF INTERVIEW (minutes)
Doctor ‘A’	Emergency Department	60
Doctor ‘B’	Department for Community Programmes	75
Doctor ‘C’	Department of Obstetrics and Gynecology	30
Doctor ‘D’	Department for Community Programmes	50
Doctor ‘E’	Department of Dermatology and Venerology	60
Health Officer	Department for Community Programmes	35
Paramedic ‘A’	Outreach Centre	60
Paramedic ‘B’	Outreach Centre	35
Paramedic ‘C’	Outreach Centre	30
Paramedic ‘D’	Outreach Centre	30

Including the first interview at the Bolde Phediche Health Centre as mentioned above, a total of 10 interviews were conducted with the key informants stated in Table 3. For the remaining 9 interviews, prior appointments and permission were taken. I didn’t directly approach for the appointment; instead a staff from the Department for Community Programmes helped me by making telephone calls to the respective informant and asking for appropriate time. Over the telephone she said:

“We have a student from Norway and he is doing research on telemedicine. Can you manage time for interview?”

Most of the interviews were performed in English, whereas few were performed in Nepali. The duration of interviews ranged from 30 – 75 minutes. I always started the interviews with my brief introduction; followed by information on purpose and objectives of the study; and the confidentiality of informants.

I followed the interview guide but did not just adhere to the questionnaires, and tried to get in depth understanding of the situation and interpretations from the informants; which imply that interviews were semi-structured in nature. The interviews were conducted mostly in the office when available, otherwise in the staffroom. I had to interview one of the informants in the canteen because of his busy schedule.

The interviews (except the one taken at Bolde Phediche Health Centre) were recorded in a digital voice recorder as well as in my mobile phone. The purpose of using two different sources for recording was to avoid any chances of technical errors. Permission for recording the interviews were asked from each informant prior to start of the interview which was accepted by all. Short notes were also made during the interviews to aid the transcription. The recordings were transferred subsequently to a computer and then transcribed and analyzed. The transcripts were read several times to retain the facts and make appropriate interpretations.

In addition to this, I also had access to a number of electronic and paper based documents such as brochures; annual reports; documentation forms etc. which constituted a part of my data collection process.

4.3 REFLECTIONS ON METHOD

In this section, I will reflect on the data collection process followed in this study. With regards to that, I will discuss on the issues related to gaining access to the field, description of the study, the role I played during data collection and the validation of the research materials. The justification of the methodology will be made in accordance to Walsham (1995, 2006); Klein and Myers (1999); and Golden-Biddle and Locke (1993).

4.3.1 Access to the Field

The most important thing for a researcher is to be present at the research site for data collection. It is therefore necessary to get formal access from the organization under study. The authenticity of the findings from an interpretive study can be justified if and only if the researcher proves himself being in the field and understanding the research setting (Golden-Biddle & Locke, 1993). The same thing implies in my case also. Without having been there in the field, it was impossible to conduct this study.

During the first year of master degree, I was planning to conduct field study for the research thesis in my home country Nepal. But at that time I was not sure what I will be doing. So, I started to search for relevant information in internet regarding the telemedicine in Nepal. To be frank, I should say that I could not find much information to generate an idea for my research. I could hardly find few information about some hospitals in Nepal providing telemedicine services; which were not sufficient. I did not give up and explored more on the subject matter, and to my luck I was able to find a news article related to telemedicine at Dhulikhel Hospital. I was pleased to know about it and bit relaxed thinking that I can get something for my thesis. The reason that attracted me about the hospital is that it is the same university hospital where I practiced my hospital pharmacy training during undergraduate studies.

I found an email address of one of the project members and started communicating with him. He was very happy to know about my interest in telemedicine and shared his experience about the project and guided me to get access in the field. His experience helped me to build up some preconceptions on what I can look for during the study. With these preconceptions in mind, I decided to do my research on the same hospital and discussed about it with my supervisor. I requested him to write a recommendation letter (Appendix 3) seeking permission for data collection. My supervisor was very positive with the brief project description I submitted to him and wished me luck for the further process.

By the time I reached the hospital, there were lots of things going on my mind. On the one side I was very happy to be back to the same institution where I completed my training, whereas on the other I was frightened about '*what to do if I don't get permission?*' With

these mixed expressions, I marched towards the pharmacy store to meet the Pharmacist I knew properly and get help from him. He had little information about the telemedicine practice at the hospital and suggested me to approach Department for Community Programmes under which the outreach centres run. With his help, I met the Program Coordinator from the department and stated the purpose of my visit to the hospital. From this point onward, I started noting each and every piece of information I thought would be valuable.

The Program Coordinator introduced me to other staffs in the department and told me to talk to the Chief of the department for formal access who was on leave for few days at that time. The Department Chief was the same person whom I was referred by the project member as I have mentioned above. I quickly asked his email address so that I can inform him about my fieldwork and ask appointment as soon as he is back to work. For the next few days, I visited the hospital daily and spent my time discussing with the staff of the Department for Community Programmes regarding the telemedicine implementation and hospital organization and observing the work practice. This helped me to establish a mutual relationship with the staffs which was very important for me to get preliminary information on the users of the services and also to get in touch with other hospital staffs and doctors.

As per the appointment, I met the department chief and presented the letter given by my supervisor along with a short project description stating the purpose of my study. He was satisfied with my objective of the field work and immediately approved my access to the site. We further discussed on the subject matter, in which he gave me ideas to proceed for my study.

4.3.2 Reliability on Data Collection Tools

Getting access to the field is just the beginning of the research, since getting permission for the research is one thing whereas being accepted in the research site is another (Randall, et al., 2008). I already had the former, but the later aspect seemed challenging, since I had to maintain this throughout the study.

The principle of contextualization requires that the researcher must have a better understanding of the social and historical background of the research setting (Klein & Myers, 1999). It is therefore essential to take a close look at each and every component under the study not only in present context but also from the past to trace the changes occurred in due course. Though the hospital was not new to me, but I had to know lots of things as I was going to interact with the people that I have not met before. I had to understand how the concept of telemedicine emerged at the hospital and who were involved with the system so that I can select the key informants for my study. The informal discussions and observations performed at the beginning of the study helped me to establish a background about the research setting and also to define my research questions.

Further understanding of the situation and collection of data were performed by interviews. Interviews can be conducted via either structured, semi-structured or unstructured questionnaires (Robson, 2002) depending upon the need and subject matter under study. In this case, I followed semi-structured interviews with open-ended questionnaires. The respondents were allowed to talk freely and express their own views in order to obtain rich interpretations and maintain balance between excessive passivity and over-direction (Walsham, 1995). The purpose of choosing semi-structure interviews with open-ended questionnaires as the data collection tool was to be flexible enough during the interviews and provide opportunities to discuss on other related topics that I might have forgotten to mention in my interview guide. This interview method also allows the informants to elaborate their views and interpret in their own way (Robson, 2002) for better understanding of the real world setting.

Accordingly, major points of interest were chosen during interviews and questionnaires were developed around these topics. Further interviews developed on the basis of previous ones and new interesting topics were added to the next interviews. This process was iterative. By doing so, I was able to get richer interpretations from the informants and differentiate the fact from their prejudice. In the first principle of hermeneutic circle, Klein and Myers (1999) have mentioned that human understanding is achieved by iterating between the independent meaning of parts and the whole that they form. This means that

in order to understand the whole system or working process, it is essential to know the individual contribution or experience about the system, which can be obtained by interacting with the individual components, i.e. the parts of the system. In addition to this, Walsham (1995) argues that thick descriptions are necessary to understand the complexity of an information system and human beings who are using it.

4.3.3 My Role in the Field

Interpretive researcher has a difficult task of accessing other people's interpretations and giving his own interpretation of these interpretations. Walsham (1995) emphasizes that it is therefore important for the researcher of interpretive study to have a view of his/her own role in the study.

The third principle, i.e. the principle of interaction between the researchers and the subjects requires:

“critical reflection on how the research materials (or “data”) were socially constructed through the interaction between the researcher and the participants.” (Klein & Myers, 1999)

In the beginning of the study, I positioned myself as an outsider, since I was not a member of the hospital and had no direct stake on what they said or did. I always introduced myself as a student and maintained distance with the informants. I might have missed some confidential information in this case that insider could have collected easily, but the advantage I have experienced was that all the informant's discussed freely to the questionnaires without any hesitation unlike responding to an insider (Walsham, 1995). They were ensured that their confidentiality will be maintained. This helped me to develop trust relationship with them and thus interact more easily during the interviews.

At first I didn't realize that my presence in the field was noticed. But later on, whenever we met again either on the way or at canteen we used to have informal talks and gossips related to my research. The informants often asked me questions like *“what can be done*

further to improve teleconsultation?" and so on. Accordingly, I used to interpret the findings of my study so far and try to relate it to their queries. To my surprise, one of the informants said:

"You will be the best ambassador [for telemedicine] because you know our strength and willingness."

At this point, I felt that I have been able to know some of the insights like an insider. As Forsythe (1999) argues that it is a misconception to say insiders can do ethnography in better way than the outsiders and further claims that an outsider with inside experience usually suits best for an ethnographic research. I position myself to this, because being just an insider might have led me to express my own preconceptions or assumptions as obvious truths and forbid the informants to be more open in some cases (Forsythe, 1999; Randall, et al., 2008).

Throughout the field study, I possessed good social skills (Walsham, 2006). During the interviews I never interrupted the informants; rather I listened to them interestingly and let them talk. Though we started to behave like a part of the team, I always remained unbiased with what they said. Most of the times, I maintained eye-to-eye contact (except while writing important notes) so that they remained positive towards my interest on the information provided by them. I never stick on to my preconceptions; rather I challenged them and tried to go deep into the interpretations made by the informants. This can be reflected to the principle of dialogical reasoning (Klein & Myers, 1999) which suggests that sometimes the interpretive researchers need to criticize their preconceptions if incase the research finding contradicts with that of the preconceptions.

Sometimes I used to ask them *"Did you meant to say.....?"* in order to be sure that what I understood was exactly what they meant to express. Also I used to ask opinions on the information delivered by one informant with the other, to check how far they agree with each other. I usually did this by asking questions like *"I have found that, what are your views on this?"* Since the informants in my case were from different professional background and hospital departments, it was obvious that multiple views would be

presented on the same subject matter because of their different interests and expectations. As the data collection progressed these multiple interpretations became very significant to understand how different actors in an organization with various professional backgrounds react in similar conditions as reflected by the principle of multiple interpretations (Klein & Myers, 1999).

I was always punctual for the interview. However apart from having appointment, I had to wait sometimes for the informants to be free from their work. I never rushed to them saying I have an appointment; instead I waited outside the office for my turn. Once I had to wait for around 45 minutes to meet a doctor. For the first 30 minutes, I just sat on a chair next to his office. Then I thought that he might have forgotten about the appointment as he was busy with his patients. To draw his attention towards me and make him aware of my presence, I sat on a chair just in front of his office door, so that he could see me as soon as the door opened for next patient. Eventually, he recognized me and we had to postpone the appointment for another day as the patients were still in queue.

4.3.4 Authenticity of the Findings

Conducting field work alone is not sufficient to convince the audience. It is equally important to convert data into text and interpret them in a meaningful way. According to Golden-Biddle and Locke (1993), the authenticity, plausibility and criticality of the text must be justified in order to convince the intended audience, so that the findings from the research can be used as a reference for further work. The trustworthiness of the research material should be established from the very beginning. Just interviewing or observing in the field is not enough for an interpretive research. The significant role for a researcher is to capture what the informants' say and what he observes.

To make the data authentic, it requires that the researcher has understood the research setting and its members. Accordingly, I have tried my best to gather much information as far as possible. I spent most of the time in the field observing the work practice and interacting with the informants and other staff at the hospital. Even during free time I used to roam here and there and observe how things go around. To be true, I was always on the field during data collection period. The interview recordings, pictures taken during the

observations and the diary that I used to note the key points during data collection constitute to be the proof of my presence in the field. Moreover, I was handed an official letter (Appendix 4) by the Chief of Department for Community Programmes which reflects the authenticity of the collected data.

The multiple interpretations in the interpretive study make it difficult for the researcher to generalize the findings, unlike quantitative studies which either falsify or justify the theory. For this reason, the use of social theories will help the researcher to interpret and analyze the empirical data (Klein & Myers, 1999). These theories can be used in three ways, as an initial guide for research design and data collection; as part of an iterative process of data collection and analysis and as a final product of the research (Walsham, 1995).

In this case I have utilized two theories i.e. the Actor Network Theory (ANT) and the notion of Information Infrastructure (II) to generalize the collected data. The concepts of the ANT have been used both as methods and as theoretical background (Walsham, 1997). As methods, I have applied ANT to mark out probable actors responsible for the telemedicine service at the hospital and thereby identified key informants of this study. I have also used it to understand the principal interests of the informants and the ways to align them into action. Likewise, ANT and notion of II has also been taken as a theory to relate the research findings and connect them to my research questions. These theories have helped me to highlight the features of ICT infrastructure in the study setting as well as understanding the role of human actors for the widespread use of the technology.

Plausibility of the text requires the construction of a sensible story from the empirical findings (Golden-Biddle & Locke, 1993). In Chapter 5, I have presented the qualitative data collected in this study. The recorded interviews were listened repeatedly and transcribed subsequently to point out reasonable information which has been quoted word by word, as conveyed by the informants. The interpretations were then done as per my background knowledge of the research setting and theoretical concept. The purpose of quoting what informants said is to allow the readers to evaluate whether the interpretations made after data collection are in line with what have been collected and thus form a bridge between the subject matter and the readers' knowledge and experience (*ibid*). To make

sure if I have interpreted the research findings in an appropriate way, I emailed the text of research findings from the case study to two of the informants and had discussion with them accordingly.

4.4 ETHICAL CONSIDERATIONS

I have already mentioned that formal approval was requested to get access into the field and collect the relevant data. Accordingly, ethical clearance was obtained from the Institutional Review Board of Dhulikhel Hospital as mentioned in Appendix 4. The interviews were recorded as per the permission of the informants. The anonymity and confidentiality of the informants has been maintained throughout the study process.

CHAPTER 5
CASE STUDY

5. CASE STUDY – TELEMEDICINE AT DHULIKHEL HOSPITAL

This chapter outlines the empirical findings from the field study. The data collected from the field are presented in the interpreted form to build up an interpretive case study. The findings are related to the infrastructural development and the state of the art telemedicine technology at the hospital under study; users' perspectives on the usefulness and appropriateness of the technology; and strategic plan to further sustain the telemedicine system.

5.1 INFRASTRUCTURAL DEVELOPMENT OF TELEMEDICINE

5.1.1 Radio Communication –*‘the starting point’*

In order to establish contact with the outreach centres and to provide quality health services to those patients in rural areas who cannot physically come to the hospital regularly for treatment, Dhulikhel Hospital initiated wireless walkie-talkie radio based communication system during the year 2002. The setup was primarily installed in two outreach centres, namely Bahunipati Health Centre and Bolde Phediche Health Centre; and two radio setups were available in the hospital, one in guard's room and another in Director's office. Wireless radio was also available in the ambulances in order to communicate while on the way. The repeater station for transmitting the radio frequency signal to the outreach centres was placed in Palanchowk. The reason for choosing this site was accessibility of the radio frequency to both the outreach centres.

The radio communication helped in managing the patients' health through direct consultation with the doctors in the hospital. Whenever there was some emergency situation or confusion at either of the rural outreach centres, the paramedics used to seek help from the hospital. The message was first received at the guard's room and the responsible doctor was informed immediately by the attending guard. Then the doctor used to advice treatment or referral accordingly via radio placed in Director's room.

Though the wireless radio brought the hospital and the staff at outreach centres in direct contact from time to time as well as helped many patients in managing their treatment, the

communication process was a bit time consuming since the doctors had to go to the place where radio was situated. This service did not last long and halted in the year 2005 due to security reasons as well as recurrent technical problems. At that time, due to the nation's political situation, communication through wireless radios was not allowed. Apart from this, there used to be problem in the repeater station frequently because of lightning. The maintenance cost was very expensive, since the technician needed to be hired from outside the nation and the impaired part was to be imported.

5.1.2 Mobile Phones – *'the hope for continuation'*

The mobile phone services then came into action. Nepal Telecommunications Corporation (NTC), the leading and largest telecommunication company of Nepal launched Global System for Mobile Communications (GSM) mobile services in the year 1999, but due to high call tariff and low network coverage, the service was not easily accessible in all the places of Nepal. Within few years, the development in the field of telecommunication became so rapid that the mobile service became available at cheaper cost in most of the regions of Nepal. Almost all the outreach staffs and the specialist or consultant doctors at the hospital have access to private mobile phones. The paramedics at outreach centre used to call the respective doctor directly in need and ask for the required management or suggestions.

5.1.3 CDMA Phones – *'the current technology'*

To ease this communication method, Code Division Multiple Access (CDMA) mobile phones by NTC (Figure 5) were made available at all the outreach centres and special hotline mobile numbers are distributed at all the departments in the hospital since 2008. The purpose of installing CDMA phones as an alternative to GSM mobile phones at outreach centres is that it has better network coverage in rural areas of Nepal than GSM mobile service.

In addition, volume-based internet can be accessed through the CDMA phones at a speed of 153 kbps (Kilobyte per second) at reasonable price of approximately 25 paisa³ per 100 kb (Kilobyte). The CDMA phone can be connected to a computer and thus internet can be accessed. To register for internet, an activation cost of Nepali Rupees (NRs.) 200 excluding Value Added Tax (VAT) should be paid to NTC. The balance for phone call and internet can be renewed via recharge card whenever needed.



Figure 5: CDMA Phone at Outreach Centre

Other than consultation via telephone, the hospital also planned to initiate email based store-and-forward consultation for dermatology cases. To fulfill the purpose, ‘Canon

³ Paisa is the smallest unit of currency in Nepal. [1 Nepali Rupee = 100 Paisa]

DIGITAL IXUS 80 IS' digital camera (Figure 6) and Pentium 4 desktop computer (Figure 7a) were provided to the outreach centres.



Figure 6: Digital Camera at Outreach Centre



(a)

(b)

Figure 7: Telemedicine Infrastructural Setup at Outreach Centre

In order to receive internet signals, receiver as shown in Figure 7b is installed at Bahunipati Health Centre and Bolde Phediche Health Centre. The store-and-forward based email consultations for dermatological cases are done through this internet connection. Since internet is available only in above mentioned health centres at the moment, the computer at other outreaches are being used to keep electronic records of medicine stock at stores and other administrative works.

5.2 TELECONSULTATION – ‘when’ and ‘how’

For telephone consultation, the paramedics call in the hotline number of respective department and the on-call doctor attends the call and advices accordingly. If the on-call doctor is busy then the paramedics are free to call other doctors of the department in their private mobile phones.

The teleconsultation practice by different health workers are quoted below:

“In surgical or medical emergency cases, paramedics at outreach give full history in telephone and accordingly I suggest them what to do about treatment and when to refer or how to refer to the hospital. It helps in timely treatment at their level.” (Doctor ‘A’)

“Whenever the outreach health workers get confused, or require any sort of advice for treatment related to gynecology and obstetrics, they call me on hotline number or my private mobile. They present the history and scenario as far as they observe and in the view of that I advice them. They try to do as I tell them, but if they can’t do the treatment then I further suggest on how to transfer to the hospital and how to provide first aid during the transfer.” (Doctor ‘C’)

“If there were any complications or confusion, beyond my experience and knowledge, I used to call the doctor at Dhulikhel Hospital. At first signs, symptoms and other investigations that have been done were said.

Sometimes, the doctor asked to perform additional investigations or laboratory examinations that I had missed. After doing so, the doctor was called again to inform about the reports and findings. Depending on what I said, treatment if possible in the outreach was guided otherwise, referral to the hospital either Dhulikhel Hospital or other specialized hospital was advised.” (Paramedic ‘A’)

In order to make the telephone consultation as well as store-and-forward services run successfully, the Department for Community Programmes conducted training to all the outreach staff. Basic training on working with computer and simple programs like WORD, photo editing etc., internet and email were given at first phase. After this training, the word “telemedicine” was introduced in the hospital. Currently, telephone consultation is practiced more often than the store-and-forward method, since internet is not available in all the outreach centres except Bahunipati Health Centre and Bolde Phediche Health Centre.

5.3 USERS’ PERSPECTIVES ON TELEMEDICINE

According to the informants in this study, the users of the telemedicine services are the paramedics and the consultant doctors, but the one who gets direct benefits from it is the patient in rural areas. The consultants, paramedics and staff from Department for Community Programmes have found the telephone consultation and store-and-forward method via CDMA technology to be very helpful during management of emergency and life-threatening cases as well as dermatological cases at outreach centres.

5.3.1 The Potential Benefits

“Basic communication has saved human lives in the outreach. Telemedicine is for the rural people, so the advantage is that it can provide same level of management to rural areas at cheap price and short time where transportation is not frequent and the road is not good.

It takes about 5 hours to reach the hospital from some outreach centres and sometimes more than that.” (Health Officer)

“Initially walkie-talkie radio set was used, but since last 2 years I have been asking for advice through CDMA phones. It is more useful than the previous technology, because now I can contact doctor personally and the situation to reach near the radio set for consultation no longer exists and hence it saves time.” (Paramedic ‘C’)

“When there was no consultation, I had to give medicines haphazardly as per my knowledge. But after the telephone consultation started, case management became easier and successful. I could do the right thing at right time and prevent polypharmacy.” (Paramedic ‘A’)

“Tele dermatology through store-and-forward method is successful in Nepal and is the cheapest method. In dermatology, we can diagnose through pictures. A picture says 1000 words. If proper guidance is done to click good quality pictures than 60-70% of diagnosis can be done. For further enquiry, a short history is written in email. Till now we have achieved 100% success in treatment via this method.” (Doctor ‘E’)

“Telephone consultation is very good because there is no ‘tomorrow’ or ‘after a while’ in obstetrics cases. Women can die due to huge blood loss, so it has helped to reduce maternal mortality to some extent.” (Doctor ‘C’)

From the above quotes it is clear that telemedicine has proven to improve the health condition in the rural areas. It has been able to provide quality health services to the rural patients who have no alternative other than spending time in travelling to the hospital for hours and worsening the case without any preliminary management. Even a simple communication media, i.e. telephone has been very supportive in providing specialists

care to those patients while being on their own place (as far as possible), or if the treatment requires further access to hospital then proper first aid management for safe transfer of patient as advised have helped in stabilizing the patient condition and quick recovery.

With the advancement in technology and infrastructural development in health sector, telemedicine has become a need in rural areas of country like Nepal, where the basic infrastructures such as roads and easy access to health centres have not developed properly. Even if the patients are taken to the nearest health centres, the specialist doctors are still lacking that might result in improper management and sometimes death. Though referral is must in severe cases, a telephone consultation with specialists at hospitals will be beneficial for the patient as well as paramedics working in rural health centres. The patient gets a recommended treatment or first aid prior to further management, whereas the paramedics obtain education, knowledge and confidence for managing similar cases in future as soon as the patients are brought to the health centre.

“Patients get direct benefit due to consultation. In addition, we also get an advantage to know case specific treatments and management that we were unaware of and develop our confidence in handling such cases in upcoming days.” (Paramedic ‘B’)

“Telephone consultation is not only for patients’ health management. It has also enhanced my knowledge and can be taken as means of educating paramedics at rural health centres.” (Paramedic ‘D’)

5.3.2 Paramedics as ‘go-betweens’

Though patients have not been interviewed in this study, it is believed that the patients are satisfied when the paramedics call the doctors at hospitals. The informants agree that the telephone consultation not only improves the relation between health workers and the patient, in addition it also assists in convincing the patient for better treatment options.

“Some patient does not want to travel to hospital, but when we convince by saying that the doctor wants him to come to hospital for further treatment, he agrees.” (Paramedic ‘D’)

“The only person who is trusted over there are the paramedics. I think the patient will feel good when a paramedic calls me or another doctor, since he is aware that a senior doctor or specialist is being consulted.”
(Doctor ‘A’)

But when a paramedic makes a telephone call to a doctor, the patient might sometimes take it negatively. He may assume that the paramedic is not being concerned about his case and is just engaged in talking on phone, or he may also think that the paramedic knows nothing and thus he is seeking help from his seniors. This type of thinking is very common in most places of Nepal. Thus it is important to inform patient or the patient party before making call to the doctors. Prior notification to the patients about the consultation helps to build up their trust in the paramedic regarding better treatment and management of their problem.

“Patient should be well informed regarding what is going on with his case. Prior to making a call, it is the duty of paramedics to notify patient about the consultant and purpose of calling him.” (Doctor ‘B’)

“If we tell the patient and his caretaker about the telephone consultation as well as who is going to be consulted and why, then they will cooperate, and it will maintain the trust between us.” (Paramedic ‘B’)

Consulting through a telephone can sometimes be difficult, especially when a paramedic has to summarize medical history and symptoms as described by patient in few minutes to doctor. This can sometimes lead to misinterpretation or wrong diagnosis, though it does not happen so often.

“First we ask patient about his symptoms. He explains what has happened for about 10-20 minutes, and then we have to deliver same thing to the doctor in less time. There are chances of missing important information sometimes.” (Paramedic ‘A’)

The patient usually describes his symptoms in the local language. This language barrier can also cause misinterpretation of the symptoms. Translating exactly what the patient says to medical terms can be problematic.

“There are many local terms like ‘goli’, ‘gano’ [as said in Nepali language] and I don’t understand what it exactly means. I think the paramedics also face the same problem when they say it to me in medical terms.” (Doctor ‘A’)

But most of the informants believed that, there are no more language barriers now days. The paramedics have good knowledge regarding medical terms and practices in rural health centres and since telemedicine is a team work between paramedics and doctor, they will find the possible way out.

5.3.3 Socio-technical Hindrances to Teleconsultation

Technological barriers such as poor network and low connectivity are also common at outreach centres. The paramedics complain that during bad weathers the network is not available and it is difficult to contact the doctor. Due to poor connectivity, there is disturbance in two way communications and the voice is unclear. In such cases, immediate referral is the only option left with them.

Apart from this, ‘staff turnover’ has been traced out to be the major barrier to telephone consultation or store-and-forward method. The exact reason for staff turnover could not be found, but the paramedics said that there are more opportunities at Dhulikhel Hospital than the outreach centres. However, the turnover rate is not high like other institution as

reported by the Health Officer. Nevertheless it has directly affected the telemedicine practice.

“Last couple of months I am not getting any teledermatology cases from outreach. I started with a target, but I am not able to achieve it.”
(Doctor ‘E’)

Doctor ‘B’ quotes the reason as

“Initially we didn’t take the challenges for internet based services seriously like computer maintenance; training staff on use of computer and internet etc. We realized it later but we have not been able to do it till now.” (Doctor ‘B’)

It means that setting up a technology is not sufficient to get the desired result. The person using the system should have a good understanding of ‘how it works’ and ‘how it fits into the work practice’, otherwise it will stop functioning.

The Department for Community Programmes had organized trainings for the outreach staff on telemedicine. Initially the store-and-forward method was running successfully, but after the staffs changed, the service halted. Furthermore, the Health Officer adds that unless the new staff understands the overall process of telemedicine it is difficult to work with it.

The practice of documentation has also been highly affected due to staff turnover. All the outreach centres have the telemedicine documentation form (Appendix 2). The paramedic has to fill up the form after consultation and return it back to Department for Community Programmes for further documentation. Though there are some records of teleconsultation, but currently this practice is not so often. Some of the paramedics said they had no idea about the documentation form.

According to the doctors, the initiative to manage the problems related to staff turnover and discontinuation of telemedicine practice should be taken immediately. Since the outreach centres function under guidance of Department for Community Programmes, the staffs at the department are looking forward to manage the overall telemedicine process from consultation to documentation, as quoted by Doctor 'B' as follows:

“The irregularity of the service is our drawback. Telemedicine in our hospital is not structured currently and we will do that soon.”

5.4 FACTORS BEHIND SUCCESSFUL TELECONSULTATION

Apart from the technical and social barriers, teleconsultation has become very fruitful for the patients coming at the outreach centres. I have collected few medical cases (in brief) where teleconsultation was a part of treatment process.

Medical Case Report 1: *A female with Postpartum Hemorrhage (PPH) was brought to Kattike Deurali Health Centre (one of the most remote outreach centre of Dhulikhel Hospital) in the evening. The whole villagers gathered at the health centre and the situation was getting tensed. A doctor was called at around 7-8 pm to send an ambulance, which was very difficult because of poor visibility and narrow uneven road. However, an ambulance was sent along with 2 medical interns. The doctor clearly guided the paramedic on how to stabilize the patient until the ambulance reached the health centre and was in contact from time to time. On the way, one of the wheels of ambulance got punctured. The ambulance finally reached the health centre after 6 hours and the patient was brought to hospital at around 6 am in the morning. The paramedic did the management properly as guided in telephone and was successful in stabilizing the patient's condition on the way to hospital. The patient survived after further management in the hospital.*

This case describes the condition of rural health centres in most part of Nepal, i.e. difficulty in access to the hospital. It also highlights the pressure for a paramedic working in such health centres during emergency cases and how he tries to manage the case as far as possible. The use of telephonic consultation in this case not only stabilized the patient's condition until the ambulance reached there, but also developed the paramedic's confidence to console the patient party which is very important to control the situation from getting worse.

Medical Case Report 2: *A patient with abdominal distention, vomiting and difficulty in passing stool was brought to an outreach centre. The paramedic administered enema to ease defecation, but the condition was getting worst. Immediately, the on-call doctor at Emergency Department was contacted in hotline mobile. The whole condition was reported, and the doctor diagnosed the case as 'Intestinal Obstruction' that required operation. Instant management was necessary, since the patient was in shock. He advised to give 2 liters of Intravenous (IV) fluids at fast rate and if possible to insert Nasogastric Tube. Further administration of enema was stopped and told to refer immediately. The patient was brought to hospital and operated.*

The importance of seeking help from the doctors or other senior specialists has been pointed out in the above mentioned case. The paramedic's choice to call a doctor at that situation was very crucial. If he had not done so, then the case would have gone another way. The help seeking behavior not only corrected the diagnosis and treatment pattern but also provided education for the paramedic to handle such cases more effectively with appropriate treatment measures in future.

Medical Case Report 3: *Once a patient came at Kattike Deurali Health Centre complaining of trauma in scrotum. Due to trauma there was hole in scrotum and the testes was coming out. At first the paramedic advised him to visit hospital, but he denied to do so and wanted to be treated at the outreach centre. The paramedic*

was in dilemma about 'what to do next' and consulted a doctor at Emergency Department for further suggestion. The doctor suggested him to wash the whole thing thoroughly with Normal Saline and stitch the wound as well as prescribed appropriate antibiotics. The wound healed well after few days.

The difference in this case from the others two mentioned above is that the patient wanted to get treatment right there at the outreach centre. Since the case was new to the paramedic, there would have been no alternative other than referring to hospital if there were no means to consult the doctor. It also highlights the understanding between the doctor and the paramedics as well as the doctor's understanding of the situation at the outreach centres like the availability of the resources and medicines that would best fit for the treatment.

From the above mentioned cases, it can be easily concluded that telephone consultation has aided to save lives of patients from rural areas as well as helped in providing standard quality treatment before coming to hospital. This has not only saved lives but also the time of recovery and cost of treatment. If there was no teleconsultation in above cases, the situation would have been different. The patient would have to visit hospital for further treatment which was not his desire as in Case Report 3, whereas direct referral to hospital without preliminary management in other cases would have resulted in further complications or death on their way to hospital.

A question now arises, i.e. how was this consultation successful? The answer that comes first in our mind is 'technology' which is telephone in this case. Yes, it is true but technology is not just enough for consultation in medical field.

“The physical link [technology] needs to be reliable, but we need to have human relationship also. It is necessary to know 'where the person fits in the system', 'what grade they are', 'what experience they have' and 'in what situation they are working'.” (Doctor 'D')

Relational link is as much important as the technology. Relation between the doctors and the paramedics is very important to understand the situation and patient's condition. When the paramedic is briefing about the condition via phone, the doctor should feel that he is at the site to treat the patient like in face to face contact. The doctor should know the level of knowledge the paramedic has and to what extent the paramedic can follow him. If this relational link lacks, the technology alone cannot result for successful consultation, which is one of the most important findings from this study.

“Even telephone conversations can save life, there needs to be good communication. I could consult well because the paramedics knew me and I knew them and their capacity to handle cases. I am aware of the drugs available there as well as how far they can follow me. So I could guide precisely as if I was there.” (Doctor ‘B’)

“We have good relation with paramedics; we know the settings very well. I advised clearly in the way I wanted and the way I knew they would follow and thus the patient condition improved. I cannot guide that well if I don't know to whom I am advising or in the setup I have never seen.” (Doctor ‘A’)

Such a high level of understanding between each other and the settings was possible because of interaction and cooperation during the doctors' frequent visit to outreach as well as during training program for paramedics in the hospital. The doctors have convinced the paramedics to help them whenever necessary and at anytime.

“Sometimes we try to contact the doctor, but due to their busy schedule we fail to get response. In such cases, the doctor have called back immediately after he/she is free to know what was the problem. The reason for calling back soon is the doctors know we [paramedics] are in trouble and need help from them.” (Paramedic ‘B’)

In addition to this, regular feedback about the consultation to the paramedics is also essential for making them enthusiastic to seek help whenever necessary.

“It is teamwork. People at both ends should appreciate each other.”

(Doctor ‘D’)

In medical field nobody knows everything, so the paramedics should never hesitate to ask their seniors for opinion. In return the consultant doctors should appreciate and motivate them. The paramedics should never assume that asking for advice would make doctor feel they do not know anything. Also the patient party should be said that the paramedic’s preference for teleconsultation has improved patient’s condition. This will make the patient party realize the paramedic was doing right thing at right time.

“In medical profession, if I am confused or I don’t know, I must ask my senior. Our aim is patient’s benefit. Even I open books in front of patient. So, we should encourage the paramedics to call us whenever they are in need.” (Doctor ‘C’)

“By the means of telemedicine, we are not directly dealing with patients, we are dealing with paramedics. It’s not a one time job. We should be realistic and trustworthy. Therefore, after receiving email we should give them courtesy like ‘Thank you so much’ or support them by saying ‘Good case’.” (Doctor ‘E’)

The paramedics agreed that if they receive such feedbacks, it will encourage them to use telemedicine services more frequently. They will have impression that the doctor is not bored or annoyed to provide consultation through phone or email. This will further maintain the understanding and trust between them as well as they will come to know the importance of such services in their day to day practice.

5.5 FUTURE PLAN FOR SUSTAINABILITY

The health workers replied positively towards their interest in teleconsultation. All the paramedics agreed that teleconsultation has helped a lot in their work practice and patient management has become easier than before when there were no such facilities. The doctors said they were also giving priority to teleconsultation since it has proven to be life saving in severe cases and they are happy to provide such facilities over distance through phone.

“Telephone consultation is interesting and rewarding.” (Doctor ‘A’)

They find it ‘rewarding’ because depending on what the paramedics describes about the condition of patient, the doctor has to diagnose as well as suggest for treatment and almost all the diagnosis were accurate and the paramedics were able to manage under their guidance.

5.5.1 Users’ Expectations

For making the teleconsultation run smoothly and efficiently, the consultant doctors and paramedics have felt the necessity of a separate division under Department of Community Programmes to handle such consultants. The paramedics complained that it will be difficult to contact on-call doctor when he/she is busy with other patients at hospital. Though the doctors usually calls back after they are free, but during the interval the situation of patient can deteriorate. With agreement to this the doctors further added ‘24 hour service’ can be provided within the new formed division by allocating the teleconsultation job on a rotation wise duty to General Practitioner (GP), and if GPs require assistance from specialists they can be contacted.

The Health Officer has different view on this. Appointing a GP just for telemedicine services only seems to be difficult currently but can be done in the long run when number of consultation increases and patients support it.

“Practically it is difficult to keep a GP because we don’t have regular consultation everyday and thus it is not feasible. This can be done in near future, if patient flow at outreach increases or patients are willing to accept consultation through such media.” (Health Officer)

5.5.2 Videoconferencing – ‘is it feasible?’

With such expectations, the users’ are also interested in internet based live communication methods. Some health workers have opinion that it’s the time to step up with the service, i.e. from telephone consultation to videoconferencing where they can communicate face to face.

“If we have live video communication, then doctors can see the patient directly and patient management would be well-organized at our level.”
(Paramedic ‘D’)

On the other hand, some doctors argue as on the present context of Nepal it is not feasible to establish a videoconferencing setup at all the outreaches due to socio-technical problems like load shedding, limited access to internet, limited manpower and resources.

“Many think videoconferencing is the best, but in present situation it is a failure in Nepal due to load shedding and other technical problems.”
(Doctor ‘E’)

However, Doctor ‘B’ said that the hospital administration is extremely positive towards videoconferencing. A study on the use of computer and internet based telemedicine has already been done, which proved to be very expensive. It costs around NRs. 1.5 -2 million for a single videoconferencing setup and it is not worth to put in all outreaches. The hospital can manage to invest the first time expenditure, but the running and operation cost mostly in rural areas was found to be expensive, that can be a problem in future. He further added that there is no other alternative than establishing high speed internet based

telemedicine services in the long run, in order to link rural health centres with Dhulikhel Hospital and also to link Dhulikhel Hospital with its international centres and partners.

“Since many international institutions have promised to provide lectures and seminars from their universities via videoconferencing, we have to do it.” (Doctor ‘B’)

Presently a feasibility study is under process to establish a videoconferencing setup at the hospital to link with international centres. It has been reported that the setup will be established within a year. After that, the hospital has to explore other funding sources to link the outreach centres through video communication service.

“I think that if other organizations or donor can contribute the running cost or a part of it, than it will be easy for us. Otherwise in present context we cannot afford it. But we have been exploring and it is our future strategy.” (Doctor ‘B’)

5.5.3 Slow and Steady Progression – ‘the way forward’

For the time being, improvement of the existing infrastructure and work practice; and slow and consistence progress has been the agenda for the hospital. The informants preferred to utilize the current telemedicine resources to the fullest, so that they could be perfect in using basic technology which will help them to adjust with any changes occurring in future.

“In context to Nepal, people cannot adjust easily with technology. We have to plan stepwise, because if the users don’t know about telephone consultation and basic software, they cannot perform well with live communication and advance software.” (Doctor ‘B’)

Doctor 'E' believes in "*Slow and steady wins the race.*" He further added, the hospital started with available resources and have developed infrastructure accordingly, but the resources are not being used adequately.

All the informants supported for stepwise development in telemedicine and pointed out those basic requirements (such as training, building relationship and understanding between users) which are normally omitted during implementation phase should be taken into consideration.

Accordingly, the Department of Community Programmes is working currently to develop the ongoing telemedicine services in a structured way. A separate staff has been appointed to look after the services. Evaluation of hotline mobiles; training; and staff appraisal have been planned as the next step for the smooth continuation of teleconsultation.

The paramedics expressed the need of time to time training on computer applications, handling of computer, internet, emailing, photo editing and teleconsultation services. They said that training is very important to understand how technology works in health management process, and if proper training will be given to them then the telemedicine services will run more smoothly.

In agreement to this, the Health Officer quotes:

"To make telemedicine services official; training, empowerment about what is telemedicine and how it helps, and basic knowledge of technology should be provided to the users."

The doctors also said that training will help to establish better relation with the paramedics working at outreach centres and the interruption of the service due to staff turnover can be prevented.

The Department for Community Programmes is also planning to make the teleconsultation services widely available. To promote this, interaction with health workers working at government health centres have been initiated. The information on hotline mobiles are

being provided during training program of government hospital staffs at Dhulikhel Hospital.

It is believed that when paramedics and other health workers come to training, they are not just learning, in addition they can see the available resources and come in contact with doctors in the hospital, which will make the consultation and referral process easier.

CHAPTER 6
DISCUSSION

6. DISCUSSION

This chapter aims to relate the findings from the case study with the literature review. At first, I will describe the difference of telemedicine in developing countries from the western world. I will then use the characteristics of II and the concepts of ANT as theory to relate telemedicine as an infrastructure and identify the key actors involved in the network. Finally, I will focus on the appropriate strategy to develop sustainable telemedicine services in developing countries.

6.1 TELEMEDICINE IN DEVELOPING COUNTRIES' CONTEXT

The literature review suggests that telemedicine is a tool to provide quality healthcare services through the use of ICT in those places where delivering day-to-day specialists care is troublesome. It is not a new concept in context to developed countries, where telemedicine technologies and ideas emerged around a century ago. From then till now telemedicine has undergone series of developments from telephone and TV based telemedicine to real-time videoconferencing systems. These developments did not occur overnight but took a long period of time to adjust into the medical field. During this transition period, several ups and downs were observed and finally reached to a stable state. Nevertheless there are still more to come, since the concept of healthcare delivery in these developed countries has shifted to healthcare at patients' home.

On the other side, development of telemedicine in the developing countries has not been so rapid. Despite of the extreme need of healthcare delivery through telemedicine in rural areas of such nations, infrastructural development is rather slow. Telemedicine in the developing countries is in emerging phase. As seen in this case, telemedicine is being practiced through telephone consultation and store-and-forward techniques, which initiated long time ago in the developed nations (Brown & Armstrong, 1995; Craig & Patterson, 2006; Darkins & Cary, 2000; Heagarty, 1978; Nagle, et al., 1992).

It is not that the health service providers are unaware of telemedicine and its role in healthcare delivery. Of course they are aware of the advantages of telemedicine in providing better quality health services in remote areas where availability of specialist doctors round the clock is not possible and it might require several hours of travel for the patient to come to the hospital as seen in the outreach centres. The problem is that the basic infrastructure required for installing telemedicine technologies are not developed constantly throughout the nation; thereby raising the digital divide between remote and urban areas (Geissbuhler, et al., 2003; Martinez, et al., 2004).

The findings from this study signify the same. The health professionals and the organizational members are very interested to build up a highly organized telemedicine infrastructure but currently they can't do so. The main problem is with poorly developed basic infrastructures like roads, electricity, telecommunication and internet availability. Because of this the installation of telemedicine technologies at the rural areas (where telemedicine has become a need nowadays) is very expensive and beyond the capability of the organization. Though there are possible funding sources from international agencies for installation of these infrastructures, the condition after the funding stops is still the question. The running cost of the services become equally expensive as the installation cost. So, just installing the technologies and failing to operate it consistently will increase the economic burden and thereby tend to be unethical with respect to developing countries (Wootton & Bonnardot, 2010), where there are various ways to use the funds effectively other than wasting it.

Thus it is clear that copying what the developed nations have been doing since several years at once to the developing nations will not yield same result (Pradhan, 2002). This requires that proper strategies should be developed and brought into action in order to effectively utilize the economic sources for implementing telemedicine in developing countries. Each and every single unit that constitutes an infrastructure should be analyzed properly and further decision should be taken accordingly.

6.2 BUILDING ON THE INSTALLED BASE

Since there has been a requirement of appropriate strategies to move forward with telemedicine practice, one of the right path to follow for the developing countries would be to establish telemedicine network from the existing technologies and within-country resources (Wootton, 2008).

The findings from this study justify the above statement. Telemedicine at Dhulikhel Hospital evolved slowly and continuously upon the available technologies. It took around 8 years (since 2002) for the hospital to reach the position they are now and are still in process of further development. The concept behind telemedicine did not originate out of scratch. The problems of paramedics at rural outreach centre to communicate with specialized doctors at the hospital and during transfer of the patients to hospital safely as well as the requirement of long travelling distance for the patients motivated the hospital to establish a walkie-talkie radio-based communication system initially at two outreach centres. As time passed on, the problems with this technology became visible (Bowker & Star, 1999) and the system halted. However the process never ended, but continued through newly available technology i.e. mobile phones. Currently, the teleconsultation practice has been eased by the use of CDMA phones which provide better facilities than the mobile phones and are very effective for rural areas of Nepal.

The availability of highly effective technology and the increased interests of the paramedics and doctors facilitated for the integration of technology into the medical consultation process. Accordingly further problems, requirements, users' interests and possibilities became visible. At first, teleconsultation was implemented with an objective to provide medical consultations to the paramedics, which later on turned out to be a viable source for medical education. The paramedics took it as an opportunity to learn from their seniors so that they could handle similar cases in future with ease and in turn doctors were delightful to deliver services in this new way. Later on, other aspects such as staff turnover, the need for continuous training and increased expectation of the health professional start arising (Bowker & Star, 1999). Thus it can be said that telemedicine at Dhulikhel Hospital appeared as an infrastructure which developed from an installed base,

i.e. previous ways of coping with similar conditions and introduction of technology as a solution (Bowker & Star, 1999; Hanseth & Monteiro, 1998).

Furthermore, telemedicine at Dhulikhel Hospital is not only limited to a specific person or purpose. It covers wide range of medical specialists such as dermatology, gynecology, emergency department etc. and supports the healthcare providers, doctors, paramedics and patients for diagnosis, treatment and education purposes. The number of users is not limited since the consultation can take place between any doctor and paramedic as per the need. Alongside, the technology (computer) has also been used for administrative purposes and keeping records of medicine stock along with the consultation. All these characteristics of telemedicine practice reveals the overall infrastructure to be enabling, sharing and open in nature (Hanseth & Monteiro, 1998).

Since, the hospital has planned to install videoconferencing unit in near future, the infrastructure at present and the experiences gained will therefore be a basis for development in coming days, thereby incorporating other socio-technical artifacts together and generating wide range of possibilities and opportunities to sustain.

6.3 IDENTIFICATION OF PROBABLE ACTORS

As the socio-technical artifacts perform collectively; telemedicine network becomes heterogeneous. Each of these individual components that formulate infrastructure are interrelated and forms ecologies of network (Hanseth & Monteiro, 1998) as shown in Figure 8.

Infrastructure is not simply a technology; it is a complex whole of the components (both human and non-human) that take part in one or other way during its operation process. These individual components are called the actors that affect the whole network (Aanestad & Hanseth, 2000; Callon & Law, 1995; Latour, 1991; Walsham, 1997). The probable human actors for telemedicine are doctors, paramedics, patients, IT professional, governmental bodies and the organizational members who shape the work practice and are directly involve in the acceptance of technology into it. Similarly, the non-human actors include ICT tools, training, evaluation, funding, documentation, strategy to sustain as well

as other basic infrastructures that directly affect the implementation process or indirectly evolve as a requirement while the system develops.

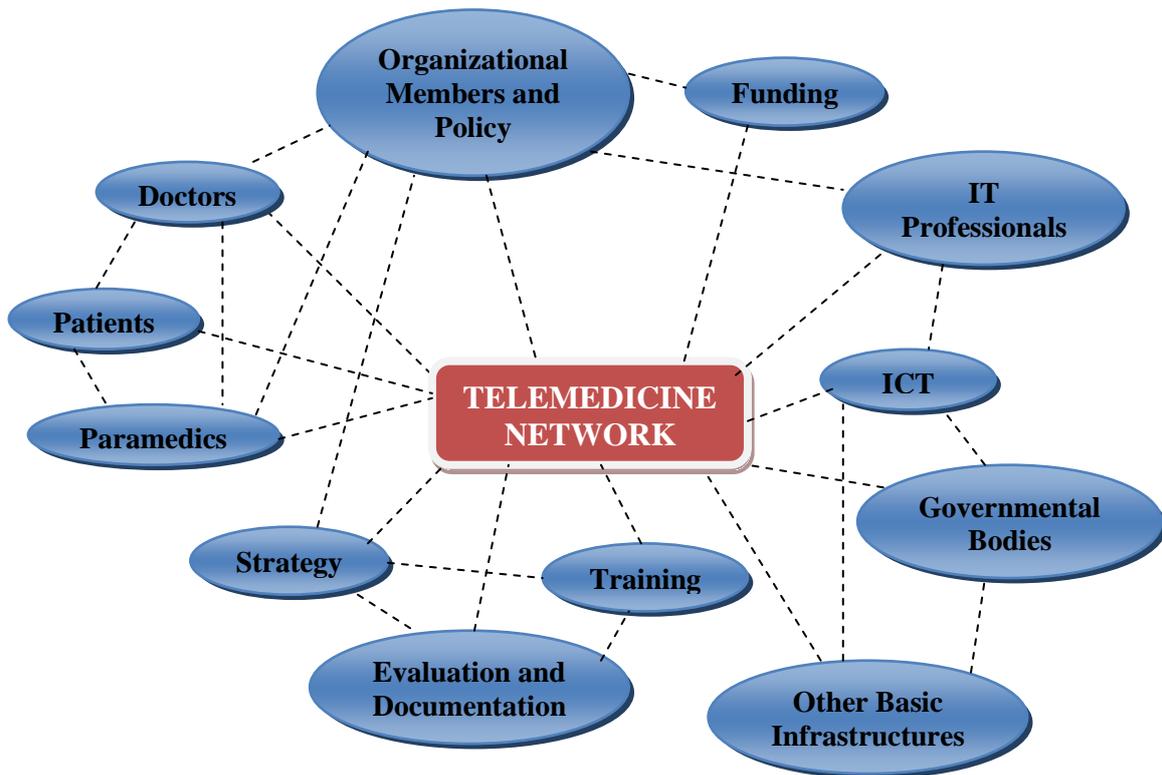


Figure 8: Network of Telemedicine Infrastructure

According to this case the doctors and the paramedics who are directly involved during teleconsultation are the major actors that influence the use of technology in the medical practice. The acceptance of technology depends on the interest of the paramedics to consult the doctors; and also the doctors' interest to respond to their queries. It has been found that both these actors should understand each other for the better consultation process, which requires building up of a relationship between them. In addition, the hospital administration should be able to choose the relevant technology for consultation and continuously monitor the system.

The paramedics in this study emphasize that there will be difficulty in consulting with the doctors whom they are not familiar with. Similarly, the doctors also feel that communicating with the paramedics who are at a distance and not knowing what situation they are in or what is the scenario of the setting would be equally difficult. This raises the

question that “*how teleconsultation can be done with satisfactory result?*” The answer suggested by this case study is to build a trust relationship between these health professionals. Both the doctors and the paramedics should know each other; whom they are consulting with; what is their background; how knowledgeable or interested they are; which outreach centre they are working at and what are the services or medicines available there.

It is not easy to establish trust between these health professionals. Each and every person should be in touch with each other from time and time. The Department for Community Programmes has done an excellent job to build this relationship. Interaction with the health workers are maintained through regular training activities for paramedics along with the medical team visit to the outreach centre routinely. As one of the informants stresses that a well established trust relationship is equally important for integrating reliable technical link, thus training can be seen as one of the actors within telemedicine network.

Since the telemedicine practice is a network of socio-technical artifacts, the trust of the health professionals on the technology should also be well established. It is not always true that each and every technology fits into the work practice very well, rather the technology should be chosen and designed as per the requirements and timely evaluation of the technology must be done to assure its consistent performance. Failure of technology to provide service when required will surely dishearten the healthcare workers and slowly the whole practice will collapse. Thus timely evaluation of the technology and work practice should be monitored and well documented as a reference.

Klein and Myers (1999) state that:

“Organizations are not static the relationships between people, organizations, and technology are not fixed but constantly changing.”

This means that the actors within the network are never the same it used to be when the system was implemented. Some of the actors go out from the network, whereas others

may join it. During the initial stage of implementing telemedicine technologies at the hospital, problems like staff turnover, requirement of follow-up training or maintenance were not taken into consideration, which later on resulted in the irregularity of the service. Similarly, as the system made its way into the regular work practice, the actors came out with new interests, expectations and suggestions which can be seen as inscriptions that need to be negotiated to continue the current services (Monteiro, 2000).

Most of the paramedics and doctors have now felt that videoconferencing is the better option for consultation which the hospital should install at all the outreach centres. In opposition few informants believe that the current technology, i.e. CDMA phones are the best for teleconsultation at the moment at outreach centres. The hospital administration is also interested to have such videoconferencing unit as the international partners have promised to provide lectures and seminar from their own place of origin. But as usual appropriate funding creates a barrier to development. The lack of funding is not the problem in this hospital only; it has been the problem ever since telemedicine emerged (Bashshur, 1995b; Darkins & Cary, 2000; Myers, 2003). The lack of funding has always resulted in the cessation of telemedicine programs worldwide and is a major issue for achieving sustainability. Therefore, funding should also be considered to be one of the main actors that can influence the development of telemedicine infrastructure to a greater extent. Hence it is required that a long term financial plan be prepared before the project starts (Vander Werf, 2004).

6.4 STRATEGY FOR WIDESPREAD USE

After identifying the key actors of a telemedicine network, focus should be made on achieving widespread use. Telemedicine is not a one time job. Once it is implemented, it should not halt, rather reasons for failure should be detected and right action should be taken.

Sustainability has always been the issue for telemedicine both in developed or developing countries, but the impact of breakdown can be seen more on developing countries. The findings from this study suggest that single videoconferencing setup costs around NRs. 1.5-2 million, which is large sum of money for organizations in Nepal and thus it is not

feasible to implement such setup in each and every rural outreach centres. Telemedicine technologies are costly, which requires lots of funding sources for the developing nations, where the required areas for investment are comparatively more than the resources. Thus failing to continue the service after making a huge investment can directly impact the national economy.

From the literature review it is clear that telemedicine during the early phases collapsed due to funding cessation, lack of interest and uptake of services, high cost of technology and above all failure to identify the site where telemedicine would have worked excellently. This further highlights that telemedicine in those days was integrated into healthcare practice without proper vision and long term plan. It was just like an experiment to study whether technology can perform at its best in the medical field or not.

As soon as the appropriate sites and situations for telemedicine implementation were found out, it started to flourish. The military services, NASA, offshore oil exploration sites and Antarctic survey stations were those sites to get direct benefit from telemedicine at that time (Darkins & Cary, 2000). This is a lesson for the institutions or organizations of today who want to implement telemedicine services in their work practice. Telemedicine sites and system should be chosen pragmatically (Yellowlees, 1997) with proper emphasis on the users' needs, expectations and interests.

With regards to developing countries, this study suggests that health workers' acceptance to telemedicine can be achieved through the use of available technologies rather than searching for other alternatives (Wootton, 2008). Being acquainted with new technology takes time and effort, especially in those conditions where the users are less friendly with technology which is the case in most developing nations. For example, installing videoconferencing system at those places where people are not used to basic telephone services will not have significant outcome. So in such cases, starting from what is available will generate enthusiasm and thus the users can look forward for accepting other better possibilities easily.

Telemedicine has already been discussed as an infrastructure possessing enabling, sharing and open characteristics (Hanseth & Monteiro, 1998). Telemedicine not only provides

medical care to patients but also provides education to those paramedics working at the rural health centres. Accordingly telemedicine technologies can also be used for various administrative and decision making purposes. Since, telemedicine is open to unlimited number of users; the infrastructure should not be just limited within the organization. Telemedicine services should be made accessible to wide group of organizations both private and governmental bodies suggested by this study. The hospital has already initiated interaction with the health professionals working in governmental hospitals and health posts to share the infrastructure and manpower. This can be seen as an initiative for a national telemedicine network thereby ensuring widespread use of the services.

Achieving wide spread use requires all the actors within the network to negotiate their needs and move forward with a common goal. If the needs contradict, infrastructure can never develop and hence will disintegrate. Thus, understanding the expectations and interests of the human actors and translating the common interest into regular work practice is very essential (Monteiro, 2000). So, these human actors should have a strong relationship between them and develop trust to ensure that technological intervention is feasible to provide quality health services to the patient in rural areas. None of the single actors (either human or non-human) within the network should be considered of less importance, because the actor that do not interfere the infrastructural development today may create problems in coming days. An example to this is the irregularity of telemedicine practice seen in this study that emerged as a result of neglecting challenges like computer maintenance, health professional acceptance of technology, staff turnover and follow-up training to the users.

Another important aspect for widespread use of telemedicine is to conduct timely training for the users involved in telemedicine consultation. Vander Werf (2004) mentions that training is a factor for successful telemedicine. Training at regular intervals will help the users to determine problems with the system and understand the ways to cope with it. It not only educates the users but also brings them in close contact with each other to share their experiences. It can be seen as a platform where the human actors within the network meet together to discuss what challenges they have faced so far; what they did to overcome it; and how they achieved the success. Training at regular interval will also

refresh the users' previous knowledge about the technology as well as the new users entering into the network will have opportunity to learn the perspectives from the past. In accordance to it, Yellowlees (2006) points out the effectiveness of training in developing confidence of the users and getting familiarity with the technology in normal healthcare environment.

Many of the telemedicine projects worldwide have failed not only because of limited funding but also due to improper planning and being unsuccessful to develop a strategy to move forward. The challenges of telemedicine described in "*Section – 2.4*" draw attention to the requirement of a well defined strategy to develop telemedicine infrastructure; from site selection to funding, and from implementation phase to sustainability. The strategy to follow might differ from organization to organization or from one country to another. But for the developing countries where the resources are limited and technology are expensive, the right thing to do as this study suggests is to start from the grass root level with the available technologies and resources and make it widely acceptable by each and every user in the network (Wootton, 2008). It will not be feasible to do what other nations have been doing since long time ago and copy it into own settings (Pradhan, 2002), since the country's basic infrastructural development and availability of resources will have a greater impact on telemedicine services.

Users participation should be done in all the stages of planning, implementation and evaluation (Yellowlees, 1997). User friendly technologies and practice will always maintain their trust on the technologies and maximum benefits can be gained. Therefore, priority should be given to identification of appropriate, available, easily accessible and culturally acceptable technologies (Marcelo, 2009). Along with this proper evaluation of telemedicine on cost, quality and accessibility of healthcare should be done on regular basis.

All these factors to ensure widespread use have to be considered in stepwise manner. Infrastructural development is an ongoing process, so the findings from this study reveal that it will be effective to develop in slow and progressive way. Telemedicine is not simply a technology; it is a network where technology is one of the parts. Sustainability can be achieved through structured telemedicine project designed with a proper vision and

long term financial planning. A well structured telemedicine network should include selection of appropriate technology, provision for evaluation and training on regular time intervals. Considering the condition of developing countries “*Slow and steady wins the race*” can be a suitable strategy to adapt. This strategy looks into each and every step with close approximation and determines the problem at these steps which can be eliminated prior to moving on. If we jump the steps, there are possibilities of falling down because the problems arising in between these steps will always be hidden. In contrast, if we raise step by step all the problems will be visible and thus necessary measure can be taken in time, as one of the informants quote:

“You have to aim high, but rise consciously and methodologically. Just simple telephonic conversation, good relationship between each other, good understanding of the step up and capabilities of staff can help save many lives.” (Doctor ‘B’)

CHAPTER 7
CONCLUSION

7. CONCLUSION

The advancement of technology and its use in medical practice have given rise to a new dimension in the healthcare service. Telemedicine has thus been able to provide quality healthcare facilities in those rural areas from where access to the hospital is time consuming. Telemedicine has proved its advantages both in developed and in developing countries. But the pace at which telemedicine is developing is different in both the cases. Developed countries initiated telemedicine long time ago, whereas in developing nations telemedicine is just emerging and is in primary phase.

The main reasons for this difference are underdeveloped infrastructures like access to electricity, telecommunication facilities along with less friendliness to ICT tools. Another reason for this underdevelopment is the economic condition. Developing nations have several other priorities where investments are to be made, and in such cases spending huge amount of money on telemedicine technologies may be a doubtful question, irrespective of the fact that the rural areas of these nations are the main places where benefits of telemedicine can be in the higher level.

In context to Nepal, problems such as frequent power cuts, limited access to internet and lack of IT knowledge are the hindrances to telemedicine. The health professionals (both doctors and paramedics) have now understood what telemedicine is and how it can help to solve the medical problems at the rural health centres, and along with it there expectations with telemedicine has also gone high. Their main interest is to have consultation via high speed internet based videoconferencing system, which in current context is not feasible to install in most of the rural areas. Though funding from external sources are quite possible for installation of the system where feasible, but the situation after this funding stops is still the dilemma.

In such cases, sitting quietly and doing nothing is not the solution. Telemedicine does not only mean videoconferencing, there are several other ways in which specialist care can be delivered to the area in needs. The findings from this study suggest that even a simple telephonic consultation during emergency situations or in confusion can help to save life

of many patients, provided that there is a reliable technical link, good relationship between the health professionals and interests in conducting consultation in such way.

Another important aspect indicated by this study is that telemedicine is not a one time job. Telemedicine is a teamwork in which various socio-technical components forms an interdependent network. Telemedicine is thus an infrastructure which develops upon an installed base and exhibits characteristics like sharing, openness and enabling. Within this network, the interests and expectations of the actors may change upon time. These varying interests must therefore be negotiated and acted upon accordingly. Sustainability can thus be achieved by making a strategic plan on what has been negotiated.

Achieving sustainability with telemedicine is another big challenge, mostly in developing countries. Failing to continue after a huge investment has been made will be unethical in such domain. Therefore proper strategic movements should be made from the very beginning. This study recommends that copying what others have done may not work in every situation. Rather starting with the available technologies and resources and practicing it in a structured way will generate positive results. Thus for developing countries like Nepal, it will be appropriate to initiate with the basic available technologies, provide timely training to the users, build relationship between them; and then slowly gain the momentum as the users become used to with the integration of technology in their regular work practice and the condition for advancement is favorable, after all its true that *“Slow and steady wins the race.”*

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APPENDICES

Appendix 1: Interview Guide

A. For Paramedics:

- i. Do they like to consult specialists?
- ii. At what situation they do so?
- iii. Is the communication media satisfactory?
- iv. How was the consultation performed?
- v. How was the experience with telemedicine?
- vi. Does doctor respond properly?
- vii. Do they understand the doctors?
- viii. How do patients react while asking for help from the doctors?
- ix. What are the barriers and drawbacks of teleconsultation?
- x. How have teleconsultation helped in improving health of people?
- xi. What are their expectations regarding telemedicine?
- xii. Have the expectations been fulfilled by the tele-consultation that is being held at the hospital presently? If not, why?
- xiii. What are the scopes of telemedicine in Nepal?
- xiv. What can be done in future to improve the current telemedicine practice?

B. For Consultants:

- i. Do they like to have consultation over telephone?
- ii. Do they understand what remote health workers define about the patient condition over telephone?
- iii. Is there any medical language problem during the consultation?
- iv. How was the experience with telemedicine?
- v. How would they evaluate whether the paramedics have understood their instructions?
- vi. What are the barriers and drawbacks of teleconsultation?
- vii. How have teleconsultation helped in improving health of people?
- viii. What are their expectations regarding telemedicine?

- ix. Have the expectations been fulfilled by the tele-consultation that is being held at the hospital presently? If not, why?
- x. What are the scopes of telemedicine in Nepal?
- xi. What roles do they play to sustain telemedicine in their work practice?
- xii. What can be done in future to improve the current telemedicine practice?

C. For Others (if any):

- i. How do they evaluate the successfulness of teleconsultation?
- ii. Has telemedicine enhanced the quality of the service provided by the hospital? How?
- iii. What roles do they play to sustain telemedicine in regular work practice?
- iv. How can barriers and challenges to telemedicine be omitted?
- v. What are the scopes of telemedicine in Nepal?
- vi. What strategies should be followed to sustain telemedicine in routine practice?

Appendix 2: Teleconsultation Form

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Dhulikhel Hospital Outreach Centre Teleconsultation form:

SN..... [redacted] Date 1/05/2008 Time 1:15 PM

Name:..... [redacted] Age 19 yrs Sex F

Address:..... [redacted]

Name of the Outreach Staff / Outreach Centre.....

Provisional Diagnosis:..... Primi at 41 wks of gest?
Not in labour.

Management:..... Clinical Exam² revealed Ut = Term size; long h.c. cep.
USG - FHS ⊕; liquor - adequate.

Categories for TM..... C..... Mode of consultation and Time.....

Name of the Dr Consulted:.....

Diagnosis after Consultation:.....

Comments from the doctor on the visit Day:.....

Other remarks:	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The connection was good					
The doctor understood the case well					
I understood the instructions of the doctor well					

Appendix 3: Recommendation Letter from Supervisor



TO WHOM IT MAY CONCERN

I, hereby, confirm that Mr. Pritam Lal Shrestha (resident of Nepal), is a Master student at University of Tromsø, Norway. He is enrolled in a 2-years program in Master's in Telemedicine and E-health. He is hard working and has good performance skills.

As a part of the curriculum in second year (Master's Thesis), he would do his fieldwork in Nepal. He requires 14 weeks to fulfill his fieldwork. During this time period, he will carry out his qualitative study and collect data.

I would like to request you for helping him in conducting the study in the best possible way.

Sincerely,

Gunnar Ellingsen

Associate professor, Department of Telemedicine and E-health
University of Tromsø, Norway.
gunnar.ellingsen@unn.no

21.05.2010



Appendix 4: Ethical Clearance Letter from Dhulikhel Hospital

DHULIKHEL HOSPITAL
KATHMANDU UNIVERSITY HOSPITAL



Date: 28th of September 2010

TO WHOM IT MAY CONCERN

This is to certify that Mr. Pritam Lal Shrestha, Master's student at University of Tromsø (UiT), Norway had been enrolled in this hospital to conduct fieldwork for his Master's Thesis. He was granted permission to carry out the data collection as required and also to visit the outreach centers. He also received ethical clearance from our Institutional Review Board to do the same.

He was free to perform the study as he followed the rules and laws of this institution throughout the study. Throughout his stay, he did his work very well and we tried our best to facilitate him in his endeavors.

I wish him all success for his work and future endeavour. Please do not hesitate to contact us if you have any queries about him or his work in our institution.

Sincerely yours

Dr. Biraj Man Karmacharya

Chief of the Department for Community Programmes



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