



MASTER'S THESIS IN TELEMEDICINE AND E-HEALTH

TLM 3902

Current Situation and Future Opportunity of Telemedicine in Bangladesh

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Abstract

Developing countries are leisurely adopter of new technologies, particularly with regards to the health services of these countries. This study explores the current health information infrastructure and future prospects of information and communication technology in health system of Bangladesh using an interpretative case study approach and proposes apply Telemedicine system to ensure health for all.

This study almost certainly the first of its variety in Bangladesh; there have been some inadequate studies of Telemedicine early trials in some developing countries assessing the challenges of implementation. This study briefly mentions one of such; the Indian Telemedicine system.

Some confronts that would obstruct the implementation of Telemedicine in Bangladesh are the initial huge start up costs, poor ICT culture of healthcare professionals and people embedding political meanings into the system. The weak state of information infrastructure at the hospital would be another challenge in implementation Telemedicine. Here Telemedicine could potentially reduce waiting times for patients, reduce the cost of the health system's operations, improve interdepartmental, inter-hospital communication and collaboration, provide opportunity for sharing best practices among physicians within Bangladesh and international hospitals, and enhance better resource allocation.

Introduction

Chapter One

1.0 General Introduction

Many developing countries have an acute shortage of doctors, particularly specialists; Bangladesh is one them. Moreover, Bangladesh is one of the overpopulated countries in the world; where the physician patient ratio is 1: 3169. As far I am conscious there is no hospital that has EMR in Bangladesh. Although, it is very common to see ‘computerized diagnostic center and hospital’ in advertisements of private health sector; they provide results of tests and receipt of payment only. I found only two articles regarding telemedicine in Bangladesh. In July 1999, the Swinfen Charitable Trust in the UK established a telemedicine link in Bangladesh, between the Centre for the Rehabilitation of the Paralyzed (CRP) in Dhaka and some medical consultants abroad. This was an evaluation of the first year’s experience with a low-cost telemedicine link in Bangladesh. Another one was about applicability of telemedicine in Bangladesh by a Bangladeshi PhD. fellow at *Inha University, Incheon, South Korea (2008)*.

This study explores the condition of information infrastructures, current situation of telemedicine and future opportunities of telemedicine in Bangladesh. The central focus was the information infrastructure and ongoing use of ICT in the health sector of Bangladesh. Almost all of workings are paper based, with only a fraction put in computers for statistical outputs for forwarding transmission to regional and national directorates.

There are a number of literatures regarding the implementation of telemedicine in developed countries. However, there is also some evaluation of implementation of telemedicine in developing countries. A search of literature reveals ‘Challenges of Telemedicine In Developing Countries’, ‘Telemedicine in India: Current scenario and the future’, ‘Information technology and telemedicine in sub-Saharan Africa’ ‘Rural Telemedicine for primary health care in developing countries and so on.

Introduction

1.1 Research Questions

- What is the current state of information infrastructure in the Health sector of Bangladesh?

- How can telemedicine improve the health service?

- What are some challenges to establish telemedicine on a larger scale in Bangladesh?

1.2 The Research Approaches Employed

To deal with the above questions, interpretative case study, practical observation analysis and interviews were employed. The study included a four week field study in the public and the private health sector of Bangladesh. A detailed description of the research method is given in chapter four.

1.3 Expected Contribution of this Research

This study could provide as the basis for advance studies of telemedicine in developing countries. The author also wishes to use this study as promotion tool for telemedicine implementation in Bangladesh.

1.4 Introduction to Bangladesh

Bangladesh is a republic with about 153 million inhabitants. The country is almost entirely enclosed by India with a small common border with Myanmar in the southeast. To the south lies the Bay of Bengal. The landscape consists of mangrove forests, bamboo forests, hills, sand dunes, alluvial islands, river deltas, mud banks and many rivers. In the southwest lie the Chittagong Hill Tracts, consisting of low hills covered with tropical rain forest remains. There is a tropical climate with monsoon seasons. Dhaka, with 10 million inhabitants, the capital and largest city of Bangladesh. Although Bangladesh emerged as an independent country in 1971, its history stretches back thousands of years. Bangladesh has long been known as a crossroads of history and culture where Muslims, Hindus Christians, Buddhists and other tribal live in relative harmony.



Fig: Political Map of Bangladesh

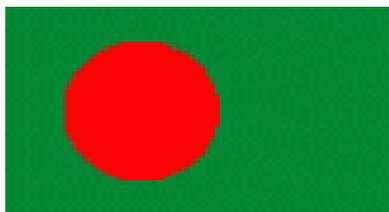


Fig: National Flag of Republic of Bangladesh

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1.5 The Organizational structure of health System in Bangladesh

Bangladesh, a developing country in south Asia has embarked on a vigorous quest of providing affordable and accessible healthcare to its citizenry over the past decades. Spending around 3.4% of its GDP over the last four years in human resource development and infrastructure in the health service (WHO 2007), there are large inadequacies in human resources and infrastructure in most parts of the country, especially in rural areas. There has also been significant progress toward the expansion of human resource development institutions and recruitment of health personnel in this health sector. Table 3-2 displays some of the indicators which reflect the health status of Bangladesh. These indicators inform that there is a long way to go to achieve the target of 'Health for all'.

HEALTH SYSTEM		
Facilities		Year
Number of hospital beds	51,648	2005
Population per hospital bed	2571	2005
Hospital beds per 10,000 population	3.43	2005
Number of health centers	1385	2004
Human resources		
Number of physicians	42,881	2005
Population per physician	3169	2005
Physicians per 10,000 population	3	2005
Population per nurses	6442	2005

Table 1.1 Major demographic and key health status indicators

These efforts to provide affordable and accessible healthcare have largely been geared toward training more healthcare professionals and the provision of physical infrastructure (Hospitals and clinics) throughout the country. The Current government has emphasized the development/adoption of new approaches of healthcare delivery. The delivery of primary health care has been taking a remarkably new shape through the establishment of 18,000 community clinics, one for every 6,000 rural populations also ICT based remote health care solutions.

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The distribution of health infrastructures can be divided into different tiers, viz, national, divisional, district, upazila (sub-district), union, ward and village levels. At the national level, there are institutes, both for public health functions as well as for postgraduate medical teaching / training and specialized treatment for patients. In each divisional head quarter, there is one infectious disease hospital and one or more medical college(s). Each medical college has an attached medical college hospital. In each district, there is a district hospital. There is a 31 to 50-bed hospital in every upazila (sub-district) level. In the union level, one or other of the three kinds of health facilities may exist, viz. in a union health facility, there is a post of medical doctor. All union facilities possess medical assistants to provide health service to the people. On the ward level, community clinics (CC), one for every 6,000 people, are being established.

Table 1.2 - Type of health facilities in different administrative tiers:

National	Divisional	District	Upazial	Union	Ward
Public Health Institute	Medical College & Hospital with nursing institute	District Hospital with nursing institute	Upazila Health Complex	Rural Health Center (in some)	Community clinic
Postgraduate Medical Institute & Hospital with nursing institute	General Hospital with nursing institute	General Hospital with nursing institute	TB Clinic (in some)	Union sub-center(in some)	
Specialized Health Center	Infectious Disease Hospital	Chest clinic (in some)		Union Health & Family Welfare Center (in some)	

The community clinics play the central role in delivering primary health care through effective community participation. A 9 to 11 member community group constituted from local people has been given responsibility to operate each community clinic. The government is providing staff and medicines. The community groups have been given orientation

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training by government. These community clinics have upward referral linkages at the unions, and upazila levels. Upazial health complexes provide a secondary level of health services.



Flow chart health Information System in Bangladesh.

(Source: eHealth strategy for Bangladesh)

The district hospitals are usually termed secondary hospitals as these have fewer specialized cares unlike many present in the medical college hospitals. There are also different types of special care centers, such as, infectious disease hospitals, tuberculosis hospitals, leprosy hospitals, which fall under secondary care health facilities. The medical college hospitals are located in the regional level, one for several districts, which are affiliated with medical colleges, and provide specialty care in many disciplines. These hospitals are called tertiary hospitals. Tertiary hospitals also include the national level super specialty hospitals or centers which provide high end medical care services for only one field.

Chapter Two

2.0 THEORETICAL FRAMEWORK

Telemedicine has been practiced successfully in many countries with the help of necessary technological and computing resources. However, most of the ICT projects being introduced investing huge funds in the health sector to facilitate care delivery have not been successful. Most of the people of this planet remain underserved due to acute lack of doctors and specialists; particularly in the developing countries. The initiation of modern communication technology has unleashed a new wave of opportunities to the delivery of health services. Even the developed countries are taking steps to establish telemedicine to reduce their health expenses. For example, The United States has a plan to establish telemedicine (EHR) for saving of some 77 Billion dollars annually, coordinate care, measure quality, and reduce medical errors (Obama's Health Policy document, 2008).

Core issues such as the state of information infrastructure, people's interactions with technology, and their acceptance of it should be critically examined during the implementation of any telemedicine system. For this thesis, I used the information infrastructure (II) and Actor Network Theories to help analyze the II state and the healthcare professional's behavior toward change in the health system.

2.1 Information Infrastructure (II) and the Implementation of Telemedicine

The technical basis for an information infrastructure (II) is the standards which regulate the communicative patterns. Any information system requires a solid infrastructure that can support the software and its users. The term **information infrastructure (II)** refers to the communications networks and associated software that support interaction among people and organizations. The Internet is the phenomenon that has driven the debate to date. The term

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Information Infrastructure (II) is useful as a collective term for present networks (i.e. the Internet) and likely future facilities.

The Free Dictionary defines 'infrastructure' as:

“The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons(Dictionary 2011).”

An **information infrastructure** is defined by (Ole Hanseth 2002) as "a shared, evolving, open, standardized, and heterogeneous installed base" and as all of the people, processes, procedures, tools, facilities, and technology which supports the creation, use, transport, storage, and destruction of information. Information infrastructure (II) is a compound of information systems and other supporting components such as shareability, Enability and Openness. II is supportive /enabling, shareable, open and heterogeneous according to Hanseth and Moniterio (1998). They also confessed that there was no clear definition for II.

Components of Information infrastructure:

Information infrastructures can be measured a balanced practical match surrounded by schedules of work practice, technology, and large range of organizational as well as technical property having clearness to communities of consumer. It is set for a wide diversity of consumers and consumer groups, and made to work in a determined way with a consulted order concerned with it. All of these features are really relevant to telemedicine arrangement, where telemedicine is being used for a huge number of consumer groups.

Information infrastructures have the belongings of embeddedness which is connected with social arrangements and technologies. IIs can reach beyond a single event or one-site practice either

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spatially or temporally. Here in information infrastructure, all new members gather a normal awareness with its bits and pieces as they become members of that infrastructure. It is significant that information infrastructures should be formed by the principle of a community practice. Apparently IIs should include embodiment of standards. II have the imperceptible quality of working structure. It becomes visible when it breaks up (Star 1999).

An instance of health care information infrastructures, the several types of information are interrelated as well as overlapping. The same information may be transmitted in different ways, for example, a digital X-ray image can be transmitted through a multi-media conferencing system or attached through an email. Moreover, one organizational unit may communicate with several units of that organization for outside of that organization in different purpose, for instance, a lab can communicate many general practitioners, other labs, other wards of the hospital. These interconnecting properties make the systems having multi-level applications and turn the systems into infrastructure (Hanseth & Monteiro, 1998).

2.2 Types of infrastructure:

Information infrastructures are making progress through the expansion of internet, infrastructures for definite business sectors and corporate infrastructures.

Global infrastructures- The internet: the internet itself is both a telecommunication and information system. It is a shared resource for billion of users all over the world. It is now used as a technological foundation for many traditional telecommunication services such as TV broadcasting, mobile phones services etc. At present, the internet is at the center of many technological developments is internet (Hanseth 1998).

Business sector infrastructures: The thought of exchange of information across organizational margins has been stretched out into different explanation shared by organizations within some

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kind of business sectors. It comprises solutions for e-commerce, extranets and telemedicine networks.

Corporate infrastructures: Currently, telecommunications is being used to support users dispersed across large geographical regions to access to the same kind of information and services. The amalgamating of telecommunication and information technologies has achieved the incorporation of information systems across any organizational and geographical borders. To improve their competitiveness, organizations are attempting to join together their different systems with those of their clients, dealers and partners all over the world (Hanseth 1998).

2.3 Characteristics of information infrastructures:

According to Hanseth et al. (1998) the term 'infrastructure' is being used in relation to information technology, to indicate basic support systems such as operating systems, communication protocols, file servers etc. The IIs can be viewed as an evolution of computer networks, distributed information systems and inter-organizational systems.

If we want to identify different characteristics of IIs, we must mention the following important features of information infrastructures:

Infrastructure is shared by a larger community

II should support multiple users, even if they are using it differently to attain a common goal. Information infrastructure is seen as irreducible, in the sense that even though the users share it they cannot split it into separate components.

The different elements of an infrastructure are integrated through standardized interfaces. Often it is argued that such standards are important because the alternative, bilateral arrangements are all too expensive. Standards are not only economically important but also a necessary

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constituting element. If an “infrastructure” is built on the basis of bilateral arrangements only, this is no real infrastructure, but just a collection of independent connections (Hanseth 1998).

Information Infrastructure and Enabling:

Infrastructure is supposed to support a large range of activities that may open up another field of new actions. The enabling function of infrastructures plays some significant roles in policy documents (Hanseth 1998).

Infrastructures are progressive, open and heterogeneous:

The information infrastructure is spontaneously progressive. For instance, telecommunication infrastructure is continuously evolving from the first communication linkage. More consumers accept this technology day by day. This nonstop expansion and advancement of IIs generate openness of infrastructure (Ole Hanseth 2002). There are no boundaries in Infrastructure for the number of users, stakeholders, application areas or network operators, thus creating an open-mode structure. For instance, in a hospital infrastructure information is being used among other institutions, social insurance offices, even in other countries.

Infrastructures are heterogeneous in character and interconnected to its different strata as in an OSI (open systems interconnection) model. Characteristics of heterogeneity depend upon several factors such as; equipment used, information, applications of infrastructure, standards of network, different implementation ways and people engaged (Hanseth 1998). Moreover, infrastructures are heterogeneous according to its building blocks i.e. technological and non-technological (human, social or organizational) (Ole Hanseth 2002).

Infrastructures are socio-technical networks:

As Information infrastructure consists of technical and non-technical components; it is obvious that, it should have socio-technical networking. It does not work without supporting people

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(Hanseth 1998). This characteristic of information infrastructures can be clearly clarified by actor network theory (ANT). Here we can mention Coiera's four rules for the reinvention of health care: "Technical systems have social consequences; Social systems have technical consequences; we don't design technology, we design socio-technical systems; To design socio-technical systems, we must understand how people and technologies interact" (Coiera 2004).

Information Infrastructure and installed base:

Information infrastructures are never developed from scratch, it is always considered as existing. The whole infrastructure cannot be changed abruptly; the new has to be connected to the old. The old one is called installed base where new one can stand. It should be integrated, or substitute a part of existing infrastructure (Ole Hanseth 2002).

2.4 The Actor Network Theory (ANT)

In recent years Actor Network Theory has become widely known and a substantial number of researchers have used the theory in their work (Walsham 1997). This theory was developed by two leading Science and Technology Studies (STS) scholars, Michel Callon and Bruno Latour, the British sociologist John Law, and others. Actor-network theory can more technically be described as a 'material-semiotic' method. This means that it maps relations that are simultaneously material (between things) and 'semiotic' (between concepts).

The term "actor-network", the A and N in ANT, is not very enlightening. It is barely obvious what the term implies. When going about doing our business — driving our car or writing a document using a word-processor — there are a lot of things that influence how we do it. For example, when driving a car, we are influenced by traffic regulations, prior driving experience and the car's maneuvering abilities; the use of a word-processor is influenced by earlier

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experience using it, the functionality of the word-processor and so forth. All of these factors are related or connected to how we act. We do not go about doing our business in a total vacuum but rather under the influence of a wide range of surrounding factors. The act we are carrying out and all of these influencing factors should be considered together. This is exactly what the term actor-network carries out. An actor-network, then, is the act linked together with all of its influencing factors (which again are linked), producing a network.

“An actor network consists of and links together both technical and non technical elements. Not only the car’s motor capacity, but also your driving training, influences your driving. Hence, ANT talks about the heterogeneous nature of actor networks” (Hanseth 1998).

ANT makes easy to understand a systemic approach of the complex dependencies and interoperability among heterogeneous elements such as human, non-human, technological and non-technological that contribute to understanding the complex healthcare system in the context of this study. As Law and Callon argue ANT diagrams the system in which actors define and allocate role, and mobilize or formulate others to play these roles. Such roles may be social, political, technical or bureaucratic in nature; the objects that are organized to fill them are also heterogeneous and may take the form of people, organizations and machines. The network image is thus a way of underlying the simultaneously social and technical character of a system long(Law 1988).

2.5 Inscription and Translation

Translation

The creation of an actor-network. This process consists of three major stages: **problematization**, **interestment**, and **enrolment**. Numerous actors within an organization may be involved in a different process of translation, each with its own unique characteristics and outcomes. For

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purposes of clarity, it is useful to focus on a single actor, from whose vantage point we wish to see the process of translation.

Problematization

The first moment of translation during which a focal actor defines identities and interests of other actors that are consistent with its own interests, and establishes itself as an obligatory passage point (OPP), thus "rendering itself indispensable" (Callon 1986).

OPP

The obligatory passage point, broadly referring to a situation that has to occur in order for all the actors to satisfy the interests that have been attributed to them by the focal actor. The focal actor defines the OPP through which the other actors must pass through and by which the focal actor becomes indispensable.

Interessement

The second moment of translation which involves a process of convincing other actors to accept definition of the focal actor (Callon 1986).

Enrollment

The moment that another actor accepts the interests defined by the focal actor.

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Inscription

A process of creating technical artifacts that would ensure the protection of an actor's interests (Latour 1992).

The interests of the actors may vary widely and may encourage or constrain the technology. In the context of this study the public and the private health institutions of Bangladesh are interested to improve their health services. Bangladesh Telecommunication Regulatory Commission (BTRC) and private mobile operators are interested to involve more people with internet connection and patients are interested to get better health services. Establishing telemedicine requires the aligning of the interests of actors within the network. As the interests of actors within the network are aligned, the network becomes stable and the telemedicine is then firmly established.

The Telemedicine and e-Health

Chapter Three

3.0 The Telemedicine and e-Health

The prefix ‘tele’ derives from the Greek word meaning ‘far’ or ‘at a distance’ or ‘remote’. Therefore the word telemedicine indicates: medicine delivered at a distance. Here is a definition that gives more specify in a few more words: “Telemedicine is the use of telecommunication to provide medical information and services”(Norris 2002). Telemedicine was fundamentally born during the ‘space race’ between the USA and the former USSR. The National Aeronautics and Space Administration (NASA), the USA military and USA Government funded many telemedicine projects. NASA was keen to build up a distant monitoring system to manage the health of American astronauts in space (Sullivan 2001).

“ Telemedicine involves the use of modern information technology, especially two-way interactive audio/video communications, computers, and telemetry, to deliver health services to remote patients and to facilitate information exchange between primary care physicians and specialists at some distances from each other”(Bashshur R 1997).

According to Norrish (2002) ‘telemedicine’ can be distinctly separated from the terms ‘telehealth’ and ‘telecare’. Telemedicine uses information and communications technology to transfer medical information for diagnosis, therapy and education. Telehealth involves information and telecommunication technologies to transfer healthcare information for the delivery of clinical, administrative and educational services. Whereas ‘telecare’ is used to describe the application of telemedicine to deliver medical services to patients in their own homes or supervised institutions.

The categorization and scope of telemedicine (and telecare) practice have changed as the technology has developed and improved a lot. At present, we can indentify four different types:

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Teleconsultation, tele-education, telemonitoring and telesurgery (Norris 2002). We can classify telemedicine in context of their services such as teledermatology, teleophthalmology, teledialysis, teleradiology, tele-otorhinolaryngology etc.

An Electronic Health Record (EHR) is an electronic adaptation of a patient's medical history, that is preserved by the provider over time, and may include all of the key administrative clinical data pertinent to that person's care under a particular provider, including demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports. The EHR automates access to information and has the potential to streamline the clinician's workflow. The EHR also has the ability to support other care-related activities directly or indirectly through various interfaces, as well as evidence-based decision support, quality management, and outcomes reporting.

EHRs are the subsequent step in the continual progress of healthcare that can strengthen the relationship between patients and clinicians. The data, and the timeliness and availability of it, will enable providers to make better decisions and provide better care.

For example, the EHR can improve patient care by:

- Reducing the incidence of medical mistake by improving the accuracy and transparency of medical records.
- Making the health information accessible, reducing repetition of tests, reducing delays in treatment, and patients well informed to take better decisions.
- Reducing medical mistake by improving the precision and clarity of medical records.

EHR is the main heart and functioning part of the telemedicine system.

Telemedicine and e-Health

Although there are no agreed international definitions for EHR, here I adopt the definition proposed by the International Organization of Standardization (ISO) in draft technical report, (ISO 2003). EHR is here defined as a repository of information regarding the health of a subject of care (patient), in computer processable form, stored and transmitted securely, and accessible by multiple authorized users. This information usually can be in the form of patient demographics, medical history, laboratory report, billing information, etc.

Overlapping terminologies such as Electronic Patient Records (EPR) and Electronic Medical Record (EMR) are sometimes used loosely as synonyms of EHR. The English National Health Service (NHS) defines EPR as “an electronic record of periodic health care of a single individual, provided mainly by one institution” (NHS 1998). EMR is defined similarly, but very much medically focused. Other lesser used terminologies such as Computerized Patient Record (CPR), Personal Health Record (PHR), Digital Medical Record (DMR), etc., have also been used in the health informatics world.

In fact, there are some special benefits of telemedicine services such as, better access to health care, access to better health care, easy access to information, justified communication between care-givers, easy to continue education regarding disease for patients and professionals, treatment procedure may have reduced cost etc (Norris 2002). Extending health care services access to rural communities and disadvantaged populations, is still one the major drivers of telemedicine.

Greater convenience to patients by decreasing travel and disruption is also a benefit claimed by the majority of telemedicine projects. Time savings for both patient and care-givers and faster access to care are similarly easy. Probably a mentionable benefit of telemedicine is the remote

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access that a patient and her or her general physician have to specialist advice when that is not available locally. Better monitoring of progress are additional advantages of telemedicine links involving a primary care doctor, a hospital specialist, a community care nurse etc. Digitized data such as patient's previous history, X-rays, test results are readily transmitted electronically using standard protocols and technologies such as email technology (Norris 2002).

Digital communication gives healthcare info that is more accurate, more complete and more timely-gives of quality that lead to better access and affordable health care. Discharge letters are similarly available without delay. Different countries are promoting a subsidized scheme for low-income families to help them gain home access to the internet. The internet could be used for health promotion with web sites targeting both children and parents. Good access to the information is concerned more with the individual endeavoring to pull information from the internet or other sources to answer specific questions. Again, better access to health care is one side of the access coin and better or proper resource utilization is the other side of the same coin. A preferred approach is therefore to set up a smaller number of resource sites and make this available for users through telemedical links. In case of teleradiology, clear cost savings have been identified. It has been around long enough for practitioners to create a marketable services and optimize the operation procedures. Therefore, for strengthening the system of health care, any health care institution can adapt the new approaches of health care technologies (Norris 2002).

The interference of technology between the patient and the carer is a potential source of argument, particularly if the electronic devices require constant adjustment or they breakdown. On the other hand, it can be pointed out that the enhancement of the patient-carer relationship when a second healthcare worker is involved. Therefore, poorer relationships are by no means automatic and are often confined to the start-up stage of a link. Norris (2002) also argues that telemedicine can characterize a threat to status and preferred practices. The likelihood of such

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threats is increased if one of the clinical participants is over-enthusiastic and tries to coerce unconvinced colleagues into using the link without due discussion or preparation.

The beginning of new technologies and methods of working always lead to some disruption and concern about the short-and long-term consequences. The US Western Governors' Association Telemedicine Action Report lists several reasons for resisting change, including: fear that telemedicine will augment the workload; be short of agreed standards. Additionally, sometimes impersonal technology may be created. The problems are most likely to occur with technophobic patients (or healthcare workers). Their occurrence is therefore greatest with elderly patients whose lack of self-reliance fuels their confusion. Careful preparation and equipment maintenance will diminish most difficulties (adapted from Norris, 2002).

According to Norris (2002), education and training are key elements but considerable overheads in a flourishing telemedicine application. Both start-up and ongoing requirements must be considered as the system develops and new staff is taken on board. The training requirement covers the setting up and use of the equipment, the teleconsultation process, and the production of appropriate documentation for these tasks and for recording the consultation procedures and outcomes. Sometimes low quality or uncertain quality of health information can be appeared at the web pages that are highly detrimental to the patients. Moreover, protocol or pathway development is one of the most important and most time-consuming aspects of the introduction of a telemedicine application.

E-health and major trend of e-health services: The use of emerging information and communication technology, especially the internet, for improving or enabling health and health care can be defined as ehealth and this 'ehealth' term bridges both the clinical and nonclinical

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sectors and includes both individual and population health-oriented tools (Eng 2001). The nature and functions of e-health services are expanding rapidly, so it is difficult to define ehealth accurately. Internet-based technologies will soon converge with satellite and cable television for full interactive broadcast capabilities delivered through seamless technology (Maheu 2000). For the hospital care setting, e-health refers to electronic patient administration systems; laboratory and radiology information systems; electronic messaging systems; and, telemedicine, teleconsultations, telepathology, teledermatology etc. In case of the home care setting, examples include teleconsultations and remote vital signs monitoring systems used for diabetes medicine, asthma monitoring and home dialysis systems. For the primary care setting, e-Health can refer to the use of computer systems by general practitioners and pharmacists for patient management, medical records and electronic prescribing. Electronic Health Record can act as a fundamental building block of all these applications. It allows the sharing of necessary information between care providers across medical institutions.

The major trend of e-health services are given below: (Andressen 2007)

- *Pure access to health information on the internet:* Internet can act as a huge resource of health related information for patients, public as well as health professionals.
- *Decision support:* Online communication or information can help patients or public or health professionals for decision making task.
- *Support for lifestyle changes:* Tailored web sites can support for lifestyle changes such as, exercise, diet control, tobacco cessation etc.
- *Open public sites (such as, Mental health, Social support) :* Here Internet plays a crucial role for mental health prevention and social support.
- *Self – help groups /psycho-educational services (individual or group):* It is going to be an integral part of treatment for emotional issues, behavior problems and mental health problems. It also deals with stressful situations. Some people believe that self-help groups are an important source for recovery and for empowerment (Focus 2007)

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- *Question-answer services:* Individual patient or groups can do it via the Internet.
- *Online – the –doctor services for direct communication with health professionals:* Internet is an excellent communication medium for this type of services such as, e-mail contact between doctor and patient.
- *E-therapy:* The delivery of mental health services through internet or online services may be called e-therapy. At present, online services are being typically delivered in the form of email communications, discussion lists, live chat rooms, or live audio or audiovisual conferencing (Gingerich 2007).
- *Web-based discussion forums:* The emergence of web-based discussion forums has empowerment, peer support and experiential knowledge effects (Madara 1997).
- *Electronic mailing lists:* At present some organizations are maintaining an electronic mailing list for their patients and organizational staffs.

Some e-health activities- consequences and benefits: Today's understanding about health is total well-being – not only to be a matter of the absence of disease (Reaburn 1998). The modern e-health era wants patients to be cooperative and participant in their treatment process. A dominate idea in the western health care system anno 2007 (Andressen 2007) is that the role of patient is shifting towards a more participating patient. It is being converted from 'passive receiver of help' to 'active participant'. People are doing a lot of health related activities via e-health services such as ordering of medicines, self-help activities, communication with family doctors or known health professionals, communication with web-doctors or health professionals, information collection before or after visit of doctors, taking decision if the person needs doctor, reading health related information. Young generations, women, patient having long-term illness are mentionable Internet health consumers. In addition, internet's democratic nature can encourage people to participate more in society as well as in their own health care by interacting with peer patients, interacting with health professional (Andressen 2007). Alternatively, e-health

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services or ICT-based services can be means to redistribute power and control providing individual citizens access to information. Information will lead to empowerment which, in turn, will lead to changes in the doctor-patient relationship (Hardey 2001).

There are lots of providers who provide information and services to patients and the public over the internet, such as: health interested people in general, non-conventional medics, commercial units, interested groups, patient organizations in general, health personnel, health care sectors, quacks, fraudsters as well (Christiansen 2007). Due to the legitimate concerns such as security and effectiveness, clinical uses of e-mediated communication are not growing up to the expected level. Patients and care providers are thinking that messages can be intercepted by unauthorized persons and it will breach the trust and legality that are necessary for the patient-doctor relationship (Car 2004). Still there is no specific health legislation for health related web sites and e-health or telemedicine services nowhere (Christiansen, 2007). But each country has its general legislation for health care.

Yet, the World Medical Association (WMA), the global representative body for physicians, has presented some responsibilities and ethical guidelines for e-health and telemedicine practices. The followings are some legal and ethical guidelines (WMA 1999) that should be considered when offering information and services to patients and the public over the internet.

- It is essential that the physician and the patient be able to reliably identify each other when telemedicine or e-health services (for example, e-mail communication) are employed.
- Patients or publics' data and other information may be sent to a physician or other health professional, only on the request, or with the informed consent, of the patient, and to the

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extent approved by given patient or public. The data transmitted should be pertinent to the problem in question (WMA 1999). As for example, an ‘Act on patient’s rights’ already has been passed in Norway (Christiansen 2007).

- Because of the risks of information leakage due to some types of electronic communication, the physician must have an active commitment to ensure that all established standards of security measures have been followed to protect the patient’s confidentiality.
- A physician practicing telemedicine or e-health services is responsible for the quality of care the patient receives.
- Calibration procedures as well as routine controls can be used to monitor the accuracy and quality of data gathered and transmitted.
- Physicians practicing e-health services or telemedicine services must be authorized to practice medicine in the country or locality in which they are located, and should be competent in their field. When practicing telemedicine or e-health services via internet (e.g., email communication, prescription over the internet) directly with a patient located in another country or state, the physician must be authorized to practice in that state or country, or it should be an internationally approved service (Adapted from WMA, 1999).

In this information Age, e-mediated communication is very useful in case of health care purposes. Bergmo et al. (2005) argues that e-mediated patient-care provider communication can promise for improving efficiency and effectiveness of clinical care and a secure web-based messaging system is an effective way for providing patient care in general physician’s practices(Bergmo 2005). In this ground, we can say, e-mediated communication is increasingly used as a way of communication between patients and the physicians (Moyer 2002).

Research studies show mixed arguments for (benefits) and against (pitfalls) e-mediated communication and doctor-patient, or peer support relationships. Some researchers such as

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Andreassen et al. (2006) have proved that e-mediated communication is affecting the context of doctor-patient interaction and in this case the element of trust in the patient-doctor relationship influences each other. The above authors argue that communication technology gives better access and promotes a personal language that provides the lower threshold for contacting the physicians. The above authors also add that technology creates the potential for the patients to share with the physicians to deal with reflexivity of modern society. Moreover e-mediated communication offers 24 hours availability, anonymity option, reduced risk of stigma and negative social reactions, tailoring to individual needs, low stress situation and so on.

E-mediated communication creates new constructions of trust between doctor and patients. Based on the data from a qualitative study performed among Norwegian patients who used information and communication technology to communicate with their doctors, 'trust' was constructed in the doctor-patient relationship. This study was conducted as part of a big project namely 'PasientLink'. In the project 6 GPs and 200 patients were recruited (Andreassen et al. 2006). Research on e-mediated communication regarding peer support relationships has positive outcomes. In a mental health discussion forum (N=492), a majority (75%) found it easier to discuss personal health problems online than face-to-face; therefore online interaction may have some unique benefits for the population suffering from mental disorders (Kummervold 2002). So, e-mediated communication increases the personal interaction thus resulting in increased peer support relationships.

E-health services and behavior changes of population: From the socio-technical literature it has been evident that "technology is society made durable" (Latour 1991) and "to design socio-technical systems, we must understand how people and technologies interact" (Coiera 2004). Now it is proven that e-health communication can improve behavioral outcomes which is really important in case of health promotion efforts. Neuhauser et al. (2003) argue for the mass customization, interactivity and convenience of technology mediated health promotion or communication that may have leading role in behavioral change of the population. E-health media can minimize many of the limitations of traditional health communications through its

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tailored, interactivity and mixed media functionalities. Neuhauser et al. (2003) mentioned some expected benefits of e-health systems such as, more participation of the users, customized information for users, '24/7' services, information related to social and life contexts psychological factors of self-efficacy of people (Rubin 2001) increasing empathy for online groups (Preece 2001) promoting interactivity and participation, providing customized and contextualized information, spreading the mix of media channels out.

To prevent diseases and reduce demand on modern health care services (Health Care Financing Administration, 2000), the betterment of health communication or services has a very important role. Health communication will be more effective when it will reach people on an emotional as well as a rational perspective, including when it relates to people's social or life circumstances. For changing people's behavior, it is necessary to combine interpersonal and mass media communications in a helpful way. Interpersonal approaches may be more effective in changing individual behavior but it is costly; on the other hand mass media communication have broader reach with its less expensive property, but includes limited capability to change population behavior. Of course, the communication must be tailored or customized according to the needs of recipients, and interactive than do generic messages or one-way communication Neuhauser et al. (2003). If we want to see e-health communication to be completely successful, it must get networked with people's social work and their behavior. In case of supporting the e-health services or communication and behavioral change, some sorts of e-health tools have been designed to support a specific behavior change such as stopping smoking, starting regular exercise, or getting a mammogram (U.S. Department of Health and Human Services, 2006). Kummervold et al. (2002) believes that online interaction can have specific benefits, such as easier to discuss personal problems, for mental disorder patients. Another positive argument is that technology has allowed tailored health communication to meet the specific needs of individuals (Bensley et al., 2004). Effective health communication, for individuals, helps to raise

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awareness of health risks and solutions, help them find support from other people, and attitude may be reinforced (National Cancer Institute, 1994).

Health promotion and e-Health services: “Health promotion is the process of enabling people to increase control over, and to improve, their health” (WHO 1986). At present internet intervention or e-health service is playing an important role for promotion of public health. In this age, internet is the latest in a series of technological breakthroughs in interpersonal communication as well as it combines very innovative characteristics such as bridging great distances and reacting a mass audience. Study regarding internet shows that both cognitive behavior therapy and psycho-education delivered through internet is effective to reduce symptoms of depression (Christensen et al., 2004).

3.1 Development of health information system in Bangladesh

There have been reforms in the last few years in the Health Information System (HIS) Bangladesh. The government of Bangladesh is very keen to strengthen the HIS in the country. Minister of Health and Family Welfare is specially interested for development of HIS through deployment of ICT and e-health systems. The HIS include collection of data from various health sources and cleaning, analyzing and summarizing the data to generate and distribute reports through routine administrative report, web site, year book, health bulletin, newsletter and so on. The existing data flow system is comprised of wireless internet network covering all health

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facilities and health administrative points from national to upazial (sub-district) levels. Several online databases have been created and also customized excel forms are being used for collecting data. These efforts are undergoing to rapidly transform all data inputs through online databases. Expansion of internet backbone downward to upazial level is being considered. The potential of telemedicine system can be expected to improve access to healthcare, and efficiency with which it is delivered. The ICT backbone as well as information culture of the Bangladesh health facilities in public sector are not yet good enough. Management Information System Health (MIS-Health) dreams of a web based centralized inventory management system to start with major equipment in each of the larger facilities with automated report generation. This database would be accessible both at policy level at the head quarter as well as at local level for local management decision. The inventory management system will gradually be expanded to include more items and to more facilities.

3.2 Implementation of Telemedicine

The demands for reasonable and quality healthcare are far from been met in developing countries, particularly in the face of limited resources, both human and capital. Bangladesh, a developing country is no exception and still grapples with the problem of providing impartial and quality healthcare to its nation. With a population of around 153 million, access to healthcare, especially for those in the rural communities is very narrow. Implementing telemedicine could help to drastically address these gaps of insufficient access and poor healthcare quality presently delivered in rural Bangladesh.

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Implementing a novel technology (such as Telemedicine), particularly in multifaceted work environments such as in the health sector requires a careful thought out plan and strategy, not only to ensure a successful implementation but also to strike a balance between conflicting important goals e.g. patient's privacy, healthcare quality, process efficiency and so on.

Whereas some dispute for the quick employment of a new technology throughout a society and then allowing users to interact and get familiar with the new technology, others are of the opinion that a thoroughly gradual deployment of a new technology should be employing it throughout the society. During this piloting are included in the training of end users.

Prototyping and piloting give the impression a more reasonable way to go. For the duration of piloting, there is sufficient time for consumers to change or improvement their technological border to lodge the new technology being initiated. Apprehensions and challenges can be concentrated on early during the implementation process. Any kind of fault can be identified and set before an organizational wide deployment new protocols can be made. The benefit of this approach is that equally organizational issues and technical issues are given cognition and concentrate on early in the implementation process.

3.3 Design and usability of telemedicine

The objective of any implementation group in initiating telemedicine should go beyond changing the way the organization does things, improving competency, etc. It should seek out to develop a practical and an acceptable Telemedicine system. The design of the telemedicine should be given much concentration as the concerns for a successful implementation. User should be implicated during the design period, and their contribution and concerns taken into account. In designing a usable and acceptable telemedicine system, the requirements of the organization should be evaluated. For most organizations it is often difficult to differentiate between a needs appraisal and a desire list; and wishes lie along a range of deployment and feasibility (Walker 2005). In this design of telemedicine service the needs of the society should be carefully balanced with what reasonable. The usability of a technology is the solution to its

acceptability by users. In scheming a telemedicine system, user interfaces should be as user responsive as possible.

Chapter Four

THE RESEARCH METHOD

Method chapter is a vital part for any type of research. Research strategy should depend upon the objectives and aims of study, it should assist researcher to find the most appropriate answers to the research question for which the study initiated. There are no exactly the right or wrong methods; there are only suitable methods for a given topic (Silverman 2005). It is very difficult to choose an suitable research method for myself as a learner. Appraising other master student's approaches and given the research questions and the anticipated impact of this research, I determined for using **qualitative research interview strategies**.

4.0 The Research Questions Guiding This Study

- What is the current state of information infrastructure in the Health sector of Bangladesh?

- How can telemedicine improve the health service?

- What are some challenges to establish telemedicine on a larger scale in Bangladesh?

4.1 Qualitative Verses Quantitative Research

Research methods are generally categorized into Qualitative and Quantitative. Table summarizes the features of qualitative and quantitative research.

Research Method

Table 4.1 Features of Qualitative & Quantitative Research

Qualitative Research	Quantitative Research
<p>Objective / purpose</p> <ul style="list-style-type: none"> • To gain an understanding of underlying reasons and motivations • To provide insights into the setting of a problem, generating ideas and/or hypotheses for later quantitative research • To uncover prevalent trends in thought and opinion 	<p>Objective / purpose</p> <ul style="list-style-type: none"> • To quantify data and generalize results from a sample to the population of interest • To measure the incidence of various views and opinions in a chosen sample • Sometimes followed by qualitative research which is used to explore some findings further
<p>Sample Usually a small number of non-representative cases. Respondents selected to fulfil a given quota.</p>	<p>Sample Usually a large number of cases representing the population of interest. Randomly selected respondents.</p>
<p>Data collection Unstructured or semi-structured techniques e.g. individual depth interviews or group discussions</p>	<p>Data collection Unstructured or semi-structured techniques e.g. individual depth interviews or group discussions</p>
<p>Outcome Exploratory and/or investigative. Findings are not conclusive and cannot be used to make generalizations about the population of interest. Develop an initial understanding and sound base for further decision making.</p>	<p>Outcome Statistical data is usually in the form of tabulations (tabs). Findings are conclusive and usually descriptive in nature.</p>

Source: <http://www.snapsurveys.com/techadvqualquant.shtml> (Accessed July.2011).

4.2 The Research Method

Qualitative research is concerned with finding the answers to questions which begin with: why? how? in what way? I share the view of Kvale (1938), with qualitative research interviews it is possible to comprehend something from the subjects point of view and to discover the implication of their experiences. Interviews permit people to express to others circumstances from their own viewpoint and in their own words. Research interviews are based on the conversations of everyday life. As he mentioned:

“ The qualitative research interview attempts to understand the world from subjects’ points of view, to unfold the meaning of peoples’ experiences, to uncover their lived world prior to scientific explanations.”(Kvale 1938).

4.3 Interpretative Research Method

Interpretative research method believes knowledge as a creation of social construction (Klein 1999). Interpretive field research includes in-depth case studies and ethnographies.

“Interpretive studies assume that people create and associate their own subjective and inter-subjective meanings as they interact with the world around them... The intent is to understand the deeper structure of a phenomenon... to increase understanding of the phenomenon within cultural and contextual situations...” (Trauth 2001).

Klein and Myers (1999) have devised a set of principles for conducting and evaluating interpretive field studies in Information System. These principles, summarized in table 4.2

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Table 4.2 summary of interpretative Field Research Principles (Source: Klein & Myers, 1999).

1. The Fundamental Principle of hermeneutic Circle
This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.
2. The Principle of Contextualization
Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.
3. 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 participants.
4. The Principle of Abstraction and Generalization
Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.
5. The Principle of Dialogical Reasoning
Requires sensitivity to possible differences in interpretations among the participation guiding the research design and actual findings (“the story which the data tell”) with subsequent cycles of revision.
6. The Principle of Multiple Interpretations
Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it.
7. The Principle of suspicion
Requires sensitivity to possible “biases” and systematic “distortions” in the narratives collected from the participants.

4.4 Research design

I had a fair idea before I went for field study what to observe, whom to interview and how to get additional information from the actors. The research was to be carried out in both public and private health sector in Bangladesh. Interpretative research method utilized for this study. Theory (ANT) and Information Infrastructure (II) will be the theories for analyzing my data.

4.5 Data Collection

Before I went for this field study in Bangladesh (March-April 2011), I conducted some phone calls; to get an update of what change had been achieved in the health sector in Bangladesh (regarding data collection) since I left for master's study in 2008.

Moreover, I have been practicing as a physiotherapist in a well-known hospital for 5 years in Bangladesh. So I have some friends and colleagues (Medical and Non-medical) who are doing their job in Telemedicine field in different organizations. Through them I contacted to the regarding personnel over phone and E-mail, consequently I got the green signal for my entry and collect data.

An introductory letter (Appendix) indicating that I am a student of UiTø, written by my supervisor was presented to the administrators of different organizations; for example Privet and Government health sector. They became very interested in my study and they gave me appointment for interviews and informed me about the date of Video Conference. They were very much interested on as I study in Norway and it has good experiences in Telemedicine field.

I was present in four video conferences two of them between BIRDEM and Faridpure Diabetic hospital and rest two were between Global Telemedicine and Appolo Hospital Chennai, India. Each conference was more or less 30-35 minutes. I situated myself as not influencer (sitting at a corner just observing). Every interview was recorded by recorder accept one person. The staffs were very willing to talk to me and were comfortable with tape recorder.

Field notes were frequently taken while at the site and additional notes made while at home about earlier forgotten and recalled events, analytic ideas and inferences, personal impressions and feeling as well as notes for further information, or observational questions. These mode of data collection were utilized.

4.6 Observation

Observation is the elemental to understand another culture (Silverman 2005). I observed the participants, how they interacted, their routines, rituals, temporal elements or critical incidents, interpretations and social organization (Denzin 1989).

4.7 Interviews

Most of the interviews were semi-structured with open-ended questions. I also used largely informal talks to get clarity of issues that were not clear to me. In total I conducted 16 Interviews; 8 face to face and 8 over phone. 15 interviews were tape recorded and others largely recorded using the traditional note taking. .

I have chosen a mentionable telemedicine effort depending upon its background regarding this field in Bangladesh. In August 16, 2005 Grameen Telecom (GTC) in cooperation with the Diabetic Association of Bangladesh (DAB) launched telemedicine services, giving patients at Faridpur (one district of Bangladesh) General Hospital access to specialist doctors of their choice in Dhaka. DAB's BIRDEM Hospital Dhaka, was connected via a video conferencing link to DAB's Faridpur General Hospital. Consultations now take place over video conference where patient and doctor see each other on television screen.

Global Telemedicine has been established 2005 to make communication between patients from Bangladesh and Appolo hospital Chennai, India. A huge number of patients are going to different hospitals in India, Thailand and Singapore every year. Now they have established video conferencing studio and giving these facilities to the patients.

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D.net is a non-governmental organization that used to take care of pregnant women by using mobile phone in Bangladesh. It was very much efficient for north bangle area which was under developed.

In 2010 Directorate General of Health Services (DGHS) of Bangladesh has started some initiatives of telemedicine as part of Digitalize Bangladesh; known as Mobile Phone Health Services and e-Health programs. I was able to interview The Director of MIS-Health (Management Information System-Health) and others physicians of Govt. hospitals regarding telemedicine.

The data collection has been based on qualitative approach such as interviews, documents collection, participatory observations and informal discussions etc. In qualitative approach, the data from interviews consists of direct quotations or direct explanations from people about their opinions, experiences, knowledge and feelings. The data from observations contains detailed descriptions of people’s activities, behaviors, actions and organization processes.

My interviewed subjects are:

Table 4.3 Interviews and durations

Interviewee	Department	Interaction	duration
Director #1	Management Information System D.G. Health Government of the People’s Republic of Bangladesh	F2F*	35 minutes
Physician #1	Upazila Health complex	Tel**	20 minutes
Physician #2	Upazila Health complex	Tel**	15 minutes
Physician#3	Upazila Health complex	Tel**	17 minutes
Physician#4	Upazila Health complex	Tel**	10 minutes
Physician#5	Upazila Health complex	Tel**	13 minutes
Physician#6	Upazila Health complex	Tel**	15 minutes
Director #2	D.Net	F2F*	15 minutes
ICT consultant	Global Telemedicine	F2F*	20 minutes

Chief Technology officer	Crystal Technology Bangladesh	F2F*	15 minutes
Senior Research Investigator	Icddr,b	F2F*	25 minutes
Managing Director & CEO	Interactive communication & Entertainment Technology Ltd.	F2F*	12 minutes
Chief Executive Officer	Global Telemedicine	F2F*	20 minutes
Director#3	Global Telemedicine	F2F*	35 minutes
Physician#7	Upazila Health Complex	Tel**	10 minutes
Physician RMO	Upazila Telemedicine Complex	Tel**	12 minutes

4.8 Reflections on Method:

According to second principle ‘Principle of contextualization’ of interpretive field research, the field research requires critical reflection of the social and historical background of the research setting (Klein 1999). Harper (Harper 2000) also argues that for ‘uncovering the organization’ it is very important to study the system design by an adequate field work programme, for instance, ethnographic research and the information life cycles of the given organization.

I have chosen the given effort (project) as past evidence, so many of parts including historical background are unknown for us. But we can follow the suggestions of Pettigrew (1987) that it is very important to study the content, context, and process of organization changes when researching business or organization work strategy and its implementation.

All of interviews might not be in same pattern. Depending upon the subjects and my attitude pattern of interview might be changed. Generally we can use a voice recorder for interview recording all time. It is a very good device for re-listening the interview. As, audio voice recorder does not express the emotional expression and body language clearly, so during interviewing, we should be an open and inquiring minded, a good listener, generally sensitive and responsible (Robson, 2002, p. 166-167). After asking a question to the subject researcher should be a good listener. Researcher has to listen by sense too, not

simply via the ears. To extract new information from interview without any bias and effective components researcher should have open mind and good memory.

In case of flexible research design, the project starts with a single problem that the researcher seeks to understand (Robson 2002). This statement will be reflected on this study in such a way, if we get any clue or findings to solve the problems of previously non-sustainable telemedicine approach, our study might be then helpful for future users, vendors and others. As Bangladesh Govt. already has taken some initiatives to establish telemedicine service in all Govt. hospitals in the country.

As Harper (200) says that programme of research means setting out to understand the circumstances in which some set of activities occurs the circumstances that will give those activities meaning. In addition, he also argues that description of the understanding should be rich and detailed enough to make some observed behavior understandable. In this light we have to map out the main processes of BIRDEM, understand the diversities of work within their telemedicine project to understand how different sets of actors depend upon one another. As Johnson (1978) says that, probably, all modes of scientific research involve participant observation. According to Walsham (1995), it is important for the interpretive researchers to have a view of their own role in the complex human processes.

4.9 Textual Analysis

I did extensive study of literature regarding implementation of Telemedicine, organizational restructuring and the introduction of new technologies in the health sector in general. I also studied the ICT policy of Bangladesh and budgetary allocation to the health service. These resources were accessed from the net and the library at UiTø.

Chapter Five

FINDINGS

5.0 Information Infrastructure of health system in Bangladesh

The origin of telemedicine are associated with the search for communication-based solutions to allow isolated or scattered population access to remote health services (Field 1996). Moreover, telemedicine was always considered the only feasible way to approach modern medicine services and systems in many underserved scenarios, notably those of the rural areas of developing countries. My interview with the director of Management Information System exemplifies:

“Telemedicine would be different in different place and different situation. It does not have any standard definition. Different country has different infrastructure according to their economic condition, manpower and geographical structure. If anybody uses ICT for medical care that is

telemedicine, weather it is store-forward or real time. In that sense we are doing telemedicine in Bangladesh”. (Director # 1)

Therefore, Bangladesh has built over the past decades a good network for primary, secondary and tertiary care hospitals and health centers to provide primary and referral health care to its citizens. The Management Information System (MIS)-Health works with both in Health Information System (HIS) as well as in e-Health. The activities of MIS-Health related to health information system include collection of data from various health sources and cleaning, analyzing and summarizing the data to generate and distribute reports through routine administrative report, web site, year book, health bulletin, newsletter, etc. The existing data flow system is comprised of wireless internet network covering all health facilities and health administrative points from national to upazilla levels. Data from the health facilities below the

upazila levels are sent to upazila health offices by paper-based reports where it is processed electronically. Several online database have been created and also customized excel forms are being used for collecting data. However, efforts are undergoing to rapidly transform all data inputs through online databases. Extension of internet backbone downward of upazila level is also being considered. A new addition in the health information system of MIS-Health is the GIS (Geographical Information System). GIS device called Global positioning System (GPS) has been provided, one to each of the 6 divisional and 64 district health offices of the DGHS. Using these devices, GIS-based HIS data resources will gradually be built.

The MIS-Health created a web-searchable database of the health facilities accessible to the public at its website. All health facilities other than the community clinics have been included. The list of the community clinics is being gathered to add to the database. Name, location, address, facility type and number of beds, if any, of each facility have been provided. The facilities can be sorted division, distinct and upazila-wise and automated summary can be prepared.

In May 2009 each of all upazila hospitals (418 Nos) and district hospitals (64 Nos.) of the country has been provided a mobile phone to act as a local call center for delivering medical advice 24h/7d to the citizens who make calls to the mobile phone. The numbers of the mobile phones have been circulated in the communities using local channels as well as in the web page. A doctor on duty in the hospital remains available to answer the phone call. By using this opportunity at least patients may remain in touch with a registered doctor rather than self treatment or village doctor (person who does not have right to prescribe medicine).

Although, internal information and communication infrastructure in health system of Bangladesh is still very basic, and therefore most of the interactions are 'physical' in the laboratory, wards/GPs offices and other units of the hospitals. Patient has to go physician, then will get necessary advice for investigations then go to the laboratory. Again have to go to the laboratory to collect investigations result and go to the physician.

I also asked about EHR and internal information and communication system in the government hospitals, he replied as; we just have started to work in this field and we have plan about EHR but it is true that, we don't have enough workforce yet regarding telemedicine and e-health. Awareness about this matter is very much important among the health personnel as well as the patients. He also mention that, private health sector can also take initiatives concerning this issue, as 60% of patients take health care services from private clinics and hospitals in Bangladesh. When I brought up the point about technical barriers such as internet connectivity, bandwidth, the price of computer and power supply; he described the plan has taken by the government to reduce bandwidth price and computer price.

One thing must be mentioned that ICT is only a technology, a technology or a machine could not be functional without a person behind. Philosophically convinced persons are the driving force for establishing an idea in to the society and state. During my study, I went through the Bangladesh health service web page and collect mobile phone numbers for two districts one is

near to Dhaka city and another is in remote and made call to the upazila hospitals. I found different scenarios; somewhere other stuffs are receiving call rather than a doctor. Because, doctors are very busy with indoor and outdoor patients. Somewhere doctors are not willing to receive the call, because, they are puzzled. Peoples are abusing them or indoor patients calling them to get extra attention. As one of physicians from a district hospital exemplifies this:

“At this moment we are only 2 physicians are maintaining the whole hospital both indoor and outdoor, where as we have post for 28 physicians. If anybody calls us we cannot give him or her enough time because we are busy with patients who are present in indoor and outdoor. This initiative is very good if we have enough manpower simultaneously the user should learn how to use it. Otherwise it would be only killing time and money”.

ICT is also a combination of physical backbone and intellect. Computer Systems, Network Machineries, Software, Wire and Wireless Connectivity Systems, Broadcast Hardware and many other Hardware and Accessories are the physical backbone. The trained human behind the backbone are the intellect. To materialize the idea of Telemedicine in Bangladesh, development of countrywide backbone and expected number of human recourses are the basic needs. On the

other hand, while mass people are concern, availability, accessibility and affordability must be ensured; otherwise the objective of health for all in Bangladesh could not be achieved properly.

A pilot project of telemedicine has been lunched in eight hospitals (two tertiary hospitals, and three district hospitals and three upazial hospitals) with high quality video conferencing equipments. I also interviewed these upazilas included in videoconferencing pilot project. Still upazila hospitals are not well equipped for diagnosis the patients. As one of the physicians from my interviewee mentioned:

“It is really a good step for rural peoples. Patients can have specialized consultancy from faraway of Dhaka. But we don’t have enough setup to diagnose the patients so; ultimately we have to send the patients to capital city Dhaka for ECG, MRI, and CT scan etc. even for digital X-ray”.

This is another challenge to establish such kind of telemedicine in Bangladesh due to lacking of laboratory for diagnosis. Even many of the district hospitals have not ECG facility consequently patients have to go to capital city Dhaka.

There are some renowned hospitals, clinics and consultation centers with diagnostic facilities those are related to telemedicine; I have chosen some of them and interviewed core personnel. BIRDEM (Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders) Hospital is one of them which is the part of Diabetic Association of Bangladesh (DAB). In collaboration of Grameen Telecom Corporation (GTC) BIRDEM’ hospital lunched a pilot project of video conferencing with Faridpur Diabetic hospital. That is situated 100 km away from main DAB in capital city Dhaka. After primary investigation of a patient by a physician all test results has been scanned and sent to DAB in Dhaka. Later than, regarding specialist doctor will give the consultancy through real time video conferencing. I was present during a video-conference I put myself in a corner and observed the whole session. Afterward I interviewed the specialist doctor and manager of this project. Studio setting was well equipped as I saw in UNN during our practical class. According to them, it being popular by the

time and they have plan to establish such kind of studio in other DAB hospitals situated all through the country, if the government reduces the bandwidth price.

There is a good trend to have sophisticated treatment among rich people from abroad. Such as India, Singapore, Thailand and other developed countries like USA, UK. Because of being neighbor India is the most preferred. It is cheaper and easier to go to India for better treatment than other country. Some private telemedicine efforts continuing cross country real time and

store forward telemedicine. **Global Telemedicine** is one of them, which has collaboration with Apollo Hospital Chennai, India. They have been practicing telemedicine since 2005 and by the time they achieved remarkable responses for patients. Global Telemedicine has a studio for video conferencing between Dhaka and different hospitals in Indian and other countries. I was able to interview the chief executive officer of Global Telemedicine and he explained their activities regarding telemedicine what they are doing and what they want to do as well as constrains to establish it in Bangladesh in large scale. A number of patients having health care services through Global Telemedicine from different countries especially India and day by day this number are increasing. He added, it is not so good for our country as well as the patients. The country is losing money and patients have to go far to achieve quality health service and pay more; where as we have all of elements to ensure these facilities. I requested for explanation how it is? He exemplifies: when a patient comes here or goes there (India) for follow-up his cardiac operation is done in last year, patient becomes very pleased by the response of consultant. It is because of database; doctors are maintaining their patient's database (EHR). Whenever a patient comes for follow-up, doctor can have all record by EHR very easily and quickly. Patients are satisfied because doctors are concerned about them. According to him our medical specialists are enough qualified but we don't have enough ICT culture among health personnel. He also mentioned other constrains such as high price of bandwidth and interrupted power supply.

Medinova Hospital has been operating a telemedicine service since 2007 by connecting patients through video conferencing with physicians in India as follow up of treatment or for assessment of initial in-country diagnosis. The aim of the service is to save cost of travel for patients and facilitate international consultation through local resources. It currently costs around Taka 7-8 thousand per consultation, including the remote physician's fee and the price of the technology.

Chapter six

Discussion

Telemedicine consist of a great prospective for modernizing the delivery of health services, serving equitable to remote areas and permitting primary care physicians to refer patients to the specialists. However, before its regular application information infrastructure (as whole; Technological and non-technological) should be reorganized. A lot of effort will have to be put in the restructuring and reorganization of workflows to effectively implement a successful telemedicine system. Of course, should be considered its accuracy and cost-effectiveness, reliability needs to be verified through evaluation. Though, Information infrastructures in Bangladesh are still weak but some of the initiatives both public and private sectors are enthusiastic.

In Bangladesh, telemedicine services are in first stage, they have motivation to improve the health care services by the implementation of telemedicine overall. As determined by Berg (2001), the implementation of comprehensive information systems or telemedicine services in health care practices has proved to be a path ridden with many types of risks, dangers and complexities. As he stated, to implement a health care information system is a process of mutual transformation; the organization and the technology transform each other during the implementation processes is a balancing act between initiating organizational change and taking information system as a change agent, without attempting to pre-specify and control the process(Berg 2001).

Here I will attempt to talk about some of the problems as well as complexities associated with implementation and management process of telemedicine in Bangladesh. In this relation, it is very imperative to remind the research questions of this thesis:

Discussion

Research Questions

- What is the current state of information infrastructure in the Health sector of Bangladesh?
- How can telemedicine improve the health service?
- What are some challenges to establish telemedicine on a larger scale in Bangladesh?

6.0 The Information Infrastructure in Bangladesh

By considering the current situation of the Information infrastructure must not be perceived simply in the light of computers, software and modern communication technologies; in case of health sector in Bangladesh present workflows and the interactions between the various actors through primary to tertiary level health services will constitute a solid foundation upon which future II can be built. The use of mobile phone to connect the primary level to secondary and tertiary level of health services can also serve as an II installed based on which future expansion of communication and data exchange can be based. The provision of video conferencing facilities to some districts and upazial hospitals and the experiences from these hospitals can facilitate the development of information infrastructure in health sector of Bangladesh.

The Benefits and Challenges of TLM Implementation

Benefits:

Discussion

The origin of telemedicine are associated with the search for communication-based solutions to allow isolated or scattered population access to remote health services (Field 1996). Moreover, telemedicine was always considered the only feasible way to approach modern medicine services and systems in many underserved scenarios, notably those of the rural areas of developing countries.

Bangladesh is one of the most densely populated countries of the world. About 153 million people living within 144,000 sq. Km. of land (1045 person/km²). There are only 663 Government hospitals in district head-quarters and upazial (sub-town) areas. Total number of beds available in both public and private hospitals and clinics is 51,648. So the ratio of one hospital bed to citizen of Bangladesh is around 1: 3.43.

From this statistics it is easily visible the inadequate healthcare infrastructure of this highly populated country. Around 80% of the total population of this country lives in rural areas. And rural health centers are often ill-equipped for proper medical treatment. Moreover most of the doctors are city based. After being selected as a cadre of Bangladesh Civil Service (BCS) usually gets employment in remote health centre of Bangladesh. Due to poor infrastructure of rural health centre and poor infrastructure of villages most of them leave the rural areas within 1-2 years and shift to city area. They feel that they become professionally isolated and outdated if stationed in remote areas.

Under this circumstance to provide health care in rural area there are two options. One is, building hospital in rural areas and also improves the infrastructure so that doctors and others staffs feel convenient to stay at that places. Another one is to take any initiative so that it is easy to access quality of health care to rural areas. To implement first one needs huge investment and time. So remaining is second one. To implement second one telemedicine is the best way to provide better health care by using maximum utilization of limited resources.

6.1 Challenges

Vast start up cost is indisputably one of the major challenges to the implementation of technologies in developing countries. The prices of personal computers have fallen over the past years. There is a happy feeling that recently, Bangladesh government took some steps to produce laptop at a very low price for students and general people with a view to establishing digital Bangladesh. They want to give people opportunity to buy laptop at a minimum prize. This project is being implemented with Bangladesh University of Engineering (BUET), Malaysia Thina Film Transistor (TFT) and other foreign specialist.

One thing must be mentioned that ICT is only a technology, a technology or a machine could not be functional without a person behind. Computers should not be a replacement for humans; it should supplement human efforts. Philosophically convinced persons are the driving force in establishing an idea into society and state. Telemedicine is an idea that includes the IT use for management, administration and governance to ensure better health services for the people.

ICT is also a combination of physical backbone and intellect. Computer Systems, Network Machineries, Software, Wire and Wireless Connectivity Systems, Broadcast Hardware and many other Hardware and Accessories are the physical backbone. The trained human behind the backbone are the intellect. To materialize the idea of Telemedicine, development of countrywide backbone and expected number of human recourses are the basic needs. On the other hand, while mass people are concern, availability, accessibility and affordability must be ensured; otherwise the objective of Telemedicine could not be achieved properly. In this case only government could not be sufficient. Public-Private partnership could be the ideal endeavor.

Power supply is a big problem in Bangladesh both urban and rural areas. Uninterrupted power supply is necessary for telemedicine. Inadequate production of electricity is a great suffering in daily life Bangladesh. Although, director of MIS disagreed with me; according to him telemedicine will be different in different situations. In which situation Bangladesh is we have to find out alternative way. We can set-up IPS (Instant Power Supply), and solar panel. Moreover, government has taken a plan to solve this problem very soon.

Discussion

To encourage the private companies in telemedicine, government has to give subsidy. For example, only for register to get internet connection with 512 kbps. has to pay 500000/. Taka. That is so much big amount for us, said director of Global Telemedicine. After that, equipment and other setup and monthly payment that is also a big amount.

6.2 TLM, Legal and Ethical Framework

In the implementation of telemedicine will present some challenges regarding patient's privacy and safety. For example, if a specialist in makes the diagnosis of a case by using telemedicine from Bangladesh or outside the country and it turns out that the diagnosis was wrong. And knowing that patients decide to take the doctor to court for professional negligence, the question now is, under which jurisdiction will the doctor be tried? There are no law regarding telemedicine in Bangladesh yet and that might be a bit worrying for those who will be implementing telemedicine system.

The Indian TLM Experience

Understanding the potentiality of telemedicine, many developing countries are implementing telemedicine to provide health care facility to remote area where health care facilities are deficient. India is such kind of country which has taken remarkable initiatives regarding this field very close to Bangladesh. The potential of telemedicine technology in providing healthcare access to rural populations and far-flung areas has long been realized by many technical ministries of the Government of India such as Information Technology, Science & Technology, and Space have been experimenting with telemedicine pilot projects since early 2000. Based on the successful outcome of these pilots, the Ministry of Health and Family Welfare has now adopted telemedicine into the National Rural Health Mission, an initiative focused on improvement of the rural healthcare delivery system. All across the country, several telemedicine

initiatives have been taken up by both government and private sector organizations with federal and state funding. Some have adopted a few modules into their health system.

ISRO's (**INDIAN SPACE RESEARCH ORGANIZATION**) satellite-based Telemedicine network through Indian Satellite System (INSAT), which started in 2001 under the GRAMSAT (rural satellite) program now includes 315 hospitals: 271 remote/rural district hospitals/health centers connected to 44 super-specialty hospitals located in major cities. Ten mobile tele-ophthalmology units are also part of this network. This has been implemented in the remote areas of northeastern states of Tripura, Nagaland and in the southern state of Karnataka in its tribal belt. District hospitals of Andaman and Nicobar Islands are linked to specialty hospitals in mainland India.

Conclusion

Chapter Seven

Conclusion

Bangladesh has been struggling to meet the basic needs of its people, such as, food, clothing, shelter, health, education and the like and to substantially raise the living standards throughout the country. In order to achieve these goals and to keep up with the rest of the world, Bangladesh, too, must start up science and technology to reach its national goals. It is only through the use of science & technology as effective instruments of change that a happy and prosperous future for the people of Bangladesh can be ensured.

A palpable force of telemedicine is the enhanced quality of treatment in underserved populations. Better treatment quality is most apparent in increased access to specialist services. Specialist access is undeniably one of the major problems facing underserved populations. Telemedicine make possible physicians in underserved areas to consult with specialists both nationally and internationally, without leaving their physical location. More rapid diagnosis and fewer missed diagnoses are other important improvements in treatment quality due to telemedicine. Other potency of telemedicine includes the decrease in patient travel for health services and the mutual exchange of knowledge among practitioners connected by telemedicine.

There is a huge disparity in health care distribution in rural and urban areas in Bangladesh. It is also suffering by lack of medical expertise and health care facilities as well as over population. In this scenario utilizing its limited resources telemedicine may be a easiest and cheapest way to Disseminate health facility to the rural Bangladesh.

Bangladesh got connected to the submarine cable network as a member of the SEA-ME-WE-4 Consortium. Several private and public telecommunication operators have established their network all over the country. As they are expanding their operation to the most rural areas, they are also dwelling to improve the network performance and inclined to introduce latest technologies to the people. Internet facility is almost available in every district of Bangladesh. The Government already has declared for giving license for 3G mobile technology to mobile companies. If government and private

organization take proper initiative then it is not so far when a patient in remote places will consult the doctors through telemedicine system.

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