Current Status and Potential of E-health in Developing Countries: A Review

A project submitted

by

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I would like to dedicate my thesis work to my loving parents, my siblings and my friends because without their love and support I won't be able to complete my work.

Certification Statement

This is to certify that this project titled, "Current Status and Potential of E-health in Developing Countries: A Review" submitted in the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy from the Department of Pharmacy , BRAC University constituents my own work under the super version of Sarah Zaheen, Lecturer, Department of Pharmacy, BRAC University, checked by Dr. Sharmind Neelotpol, Assistant Professor, Department of Pharmacy, BRAC University and that appropriate credit is given where I have used the language, ideas or writings of another.

Signed,

Countersigned by the supervisor,

Acknowledgement

At first I want to give love and thank to the Almighty Allah, who has given me the strength because of his countless blessings I am able to complete my work.

After that I would like to convey gratitude to my supervisor, Sarah Zaheen, Lecturer, Department of Pharmacy, BRAC University and my sincere gratitude to Dr. Sharmind Neelotpol, Assistant Professor, Department of Pharmacy, BRAC University for her full support, expert guidance, encouragement and understanding throughout my project work and also for her willingness to provide me necessary document and other supports whenever I needed them. Without her incredible patience and timely response and council, my project work would never be accomplished.

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Abstract

E-health has tremendous potential to ensure healthcare quality, accessibility and affordability in developing countries. Developing countries gradually adopted the new technologies particularly with regards to the health care services. Telemedicine is a way to provide medical services at community level. Telemedicine also has the potential to greatly improve the quality of health care services. It also develops the accessibility of health care system. As a result, both the quality and accessibility of improved health care systems is available for patients at low cost. This study explores and describes the infrastructure of current health care system of some developing countries. It also discussed about the future potential of Information and communication Technology (ICT). Furthermore, a set of guidelines of future perspective has been provided to aid the implementation of e-health in developing countries.

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LIST OF ACRONYMS

WHO	World Health Organization
ICT	Information and Communication Technology
CHEST	Combined Higher Education Software Team
ICU	Intensive Care Unit
MOHFW	Ministry of Health and Family Welfare
HPSP	Health and Population Sector Programs
GIS	Geographical Information System
NGO	Non- Governmental Organization
USAID	United States Agency for International Development
DGDA	Directorate General of Health Services
MDG	Millennium Development Goal
BIID	Bangladesh Institute of Information and Communication Technology in Development
GRAMSAT	Rural Satellite
D. NET	Development Research Network
MAMA	Mobile Alliance for Maternal Action
IDSP	Integrated Diseases Surveillance Project
ONCONET	National Cancer Network

ISRO	Indian Space Research Organization
INSAT	Indian Satellite System
SCPGIMS	Sanjay Gandhi Postgraduate Institute of Medical Science
MCHRC	Maternal and Child Health Research Centre
HER	Electronic Health Record
PACS	Picture Archiving and Communication System
UNFPA	United Nation Funding for Population Activity
TMIA	Thai Medical Informatics Association
MOP	Ministry of Public Health
OBCSDP	Opportune Breast Cancer Screening and Diagnosis Programs
CD	Compact Disc

CHAPTER: 1

INTRODUCTION

1.1 Background

1.1.1 Developing Countries

Developing countries are those countries where people usually have low income level and very little economic and industrial improvements and activities. Developing countries also have low standard of living. In other words it can be said that, developing countries are those countries which is a non-industrialized country and need to develop their industrial sector as well as economical side. Moreover, it can be said that, developing countries people have low income, less education, lower life expectation and these countries need more development.

There are 139 countries which are listed as developing country. Some of them include:

Bangladesh, India, Thailand, Mexico, Mongolia, Afghanistan, Bhutan, China, Ethiopia, Ghana, Honduras, Indonesia, Jamaica, Kenya, Libya, Malaysia, Myanmar, Panama, Sri Lanka, Turkey, Uganda, Vietnam, Zambia and many more.

1.1.2 Health

Healthy life is being a state of being free from any illness or injury. Health and wellbeing is an important issue for individual. Opportunity to get proper health care services and treatment is one of the basic rights of human being. It can ensure to lead a better life. Hospitals, clinics, medicines and doctors should be available and accessible to obtain quality health care services (Grad,2002). Health care services are not that much obtainable in rural areas as much it is obtainable in urban areas or cities. For maximizing the services of health care for remote areas at community levels e-health can plays a essential function.

E-health can be defines as, the application of Information and Communication Technology (ICT) to maintain the proper health condition. Public health, healthcare deliver and health related activities can seriously impacted by e-health. It is advantageous for low income and high income both countries. To overcome the national health care system challenges e-health infrastructure, networks, application and services can play a vital role (Eysenbach, 2001).

E-health helps to enables more effective decision making and enhanced quality of care. Through teleconsultation it can save thousands of lives in remote areas. Among all health care delivery system it is more convenient, efficient and cost effective. It can provide greater, faster and correct access to any patient's medical history. E-health improves the administrative competence and coordination. It can also reduce the risk of negative drug interactions and deprived response to a course of treatment. It boosts the data transfer rate. By using video technology expert diagnosis and treatment can be received at low medical cost (Eysenbach, 2001; Osby., Painter., Worthen., & Johnson.,2011).

The functional and metabolic efficiency of a living cell or organism is known as health. In case of humans, it is the ability of individual person to manage themselves or adjust themselves according to physical, mental and social changes and challenges (Huber et al., 2011). According to World Health Organization (WHO) health is, "a state of complete physical, mental and social wellbeing also the absence of diseases or infectious condition". So, health of a person strictly depends on the fundamental attainment of peace and security.

Health can be defined also as health care system, which includes people, organizations, guidelines and resources that is related to healthcare and delivers health services to patients and target population to fulfill their needs. A good healthcare system is that which is available whenever and wherever their target population need them. Country to country health care system's infrastructure can vary but one common thing in the all region is adequate numbers of workforce, well trained health workers, a goof financial mechanism to establish health care system (Nordqvist,2015).

Levels of health care: There are various systems of healthcare services which is offered for the better treatment of patients. Such as, Primary, Secondary and Tertiary healthcare.

Primary Healthcare is the first point of contact for a patient. It is usually provided by physicians, general practitioners, family doctors, dentists, pharmacists, midwives etc. It is generally understood by the communication between doctor and patients. Primary healthcare can erase the possibilities of serious health condition by diagnosis it at early age.

In addition, it can offer the best way of deal with the illness of life. Primary healthcare can be helpful in case of heart disease, stroke, cancer, diabetes, asthma etc by diagnosis

them at early stage. According to WHO, majority of the diseases can be reduced by better use of existing preventive measures and early diagnosis (Vera.& RN, 2012).

Secondary healthcare is that care when a patient go to specialist for consultation after primary care. Secondary health care is needed when the patients conditions are more complex (Vera. & RN,2012).

Tertiary healthcare is more specialized consulted care than secondary health care. It is usually addressed as hospital care. Tertiary care is offered in complicated situation and conditions (Vera. & RN, 2012).

However, all the healthcare services are not available for the people who live in rural areas of developing countries. Rural people struggles for quality health care especially in developing countries. Among all of those population of remote areas elderly people, children and adults with chronic diseases suffers the most.

Moreover, to overcome these types of challenges in health sector ICT has taken initiatives and e-heath is one of them (Vera. & RN, 2012). It plays a important role to solve this situation and also develop health care system.

1.1.3 Information and Communication Technology in health care system

The employ of ICT in healthcare sector is usually known as e-health, telehealth, and telemedicine. It not only emphasizes on the role of ICT in health care services rather than develops the way of utilization of ICT industry for the betterment healthcare system. For example, rural areas people can get expert support and opinion without even travelling there physically and it is possible by using ICT in health sector.

A journal of Combined Higher Education Software Team (CHEST) had identified that, in Intensive Care Unit (ICU) patients treated with telehealth services is discharged more quickly than the regular ICU patients. It also shows less mortality rate than the regular operation patients. So, In case of the development of health sector telemedicine is not only a necessarily but also a scope of possibility which is growing with each passing day (Ramkumar,2011).

Another most important advantage of e-health over regular system is that it is more cost effective. For example, patients of distant location can get full assessment and consultation about his illness via video consultation and is automatically generated if internet connection is available. So, Telemedicine offers us cost effective health care services which is an important factor for many patients (Jayanthi,2014).

The use of ICT has open a new era for treating patients in more successful manner. E-health is a combination of the use of information science, computer science, information technology, commerce, mobile phone and healthcare. It also includes clinical guidelines and formal medical terminologies. In other words it can be said, e-health comprises a set of different concepts and the ultimate goal is to improve the healthcare system's infrastructure and to provide better health care services especially for those people who are still unaware of quality health care (D.S.M. A. Burney,Mahmood,& Abbas,2010).

The health system throughout the world is changing day by day. The facilities of medical and their knowledge, way of consultation, training, as well as experience is changing with every passing day. Now a day's people are getting more dependent on technology. So, the use of technology in health sector will to improve the health status. However, the use of e-health must be put in context in each country especially in developing countries to fulfill health needs and to minimize the ration of critical health conditions (Shiferaw1. & Zolfo.,2012).

To promote these benefits in 1950 e-health was first used in deprived remote areas. It made a great impact on the remote areas of developing countries. E-health made special influence on those areas where experts support are rare and no developed infrastructure of health system is available. Due to the rapid advancement of ICT in health sector developed countries have accepted it instinctively. Some developing countries are also running some projects on telemedicine but more approaches in needed to make it's potential effective (A. Burney., Abbas., Mahmood., & Arifeen.,2013).

1.1.4 E-health and Telemedicine

The term telemedicine is first invented in 1970. The literature meaning of the term telemedicine is "healing at a distance". It indicates the use of ICT at distance location to improve patient's health care by exchanging and expert opinions.

"To maintain the quality of health care services and delivery of clinical care and medical information using Information and Communication Technology" is usually known as telemedicine (Kay., Santos., & Takane.,2011).

There are some other common terms includes, telehealth, telecare, teleconsultation. All of these terms include the concepts of e-health. In other words, e-health generally understood to be the application of computer, internet, mobile phone and other technologies to improve patient's healthcare.

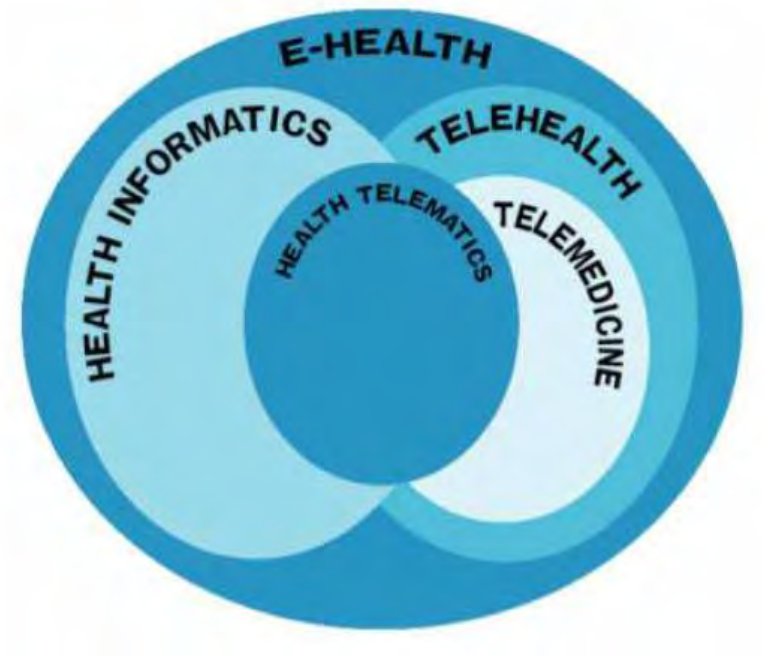

Figure 1.1: Relationship among e-health and other technologies (Alajlani, 2010).

1.2 Rationale

This is the era of technology. The use of technology in health sector will improve general people health status and also their living standard. It is important to improve the health status of people who are living in developing countries because as it will fulfill the human rights of those people. However, some projects are running in few developing countries so, the main rationale for doing this study is to create awareness among those people who are still not aware about the fact that they can get quality health care services via using simple mobile phone connection and other technologies also.

1.3 Aim and objectives:

This study is aiming to provide current scenario of e-health and e-health related projects in developing countries.

Additionally, the objectives of this study includes, summarize the current literature available about the status of e-health in developing countries. Than evaluate the potential of e-health in developing countries and finally to propose some future trajectories about e-heath projects which can be helpful for further implications.

CHAPTER: 2

METHODOLOGY

Method

The method followed for this study was an effort to gather diversity of information focusing on the topic which is collected from a variety of sources. Different papers were identified based on the topic via search engine for example, Medline, PubMed, Springer, Google scholar, Journal of health informatics etc for example as, e-health, telemedicine, telehealth, scenario of developing countries health sector and Current running e-health projects and then information has been gathered. After collecting information from different sources this study reviewed those documents about e-health and summarized those information on the initiation of developing countries e-health scenario and status. However, the following methodology is not a systemic review of current status of developing countries e-health.

CHAPTER: 3
RESULT AND DISCUSSION

3.1 Current scenario of existing e-health projects in developing countries

In last 15 years, e-health related activities have been taken place for everyone by using ICT programs (Scott. & Mars.,2015). Public and private organizations in developing countries are using different types of ICT programs project to solve their health sector difficulties. In many developing countries telehealth has been used in any disaster based humanitarian needs. For example, India, Brazil, Philippines, Nepal, Cambodia and South Africa etc. Both in India and China the recent growth of ICT programs is remarkable. However, it is expected that many countries of Africa will also show evidence of these types of activities (Ryu.,2011).

Mobile health which is also referred as m-health has open huge opportunities for the betterment of health care sector. These wireless technologies have set an extraordinary opportunity for global health care throughout the world. In remote areas of developing countries these health care facilities can make a great impact and can transform the whole health system in to a new era. As, those people of the remote areas will be able to access to quality health care via simple mobile phone connection and internet access. By mobile phone delivery of health related information and care services can be easily done in a effective and developed manner (Pattichis., Kyriacou., & Pitsillides.,2006).

Since the people of remote areas are suffering because of insufficient health care services, health providers and trained health care professionals. For minimizing these problems and the rate of death in remote areas, those people need appropriate distribution of doctors, roads and good transport system and a well developed health system infrastructure (A. Burney. et al.,2013).

By using Mobile phone people can get better health care services. The number of people using mobile apps for health services is increasing day by day.

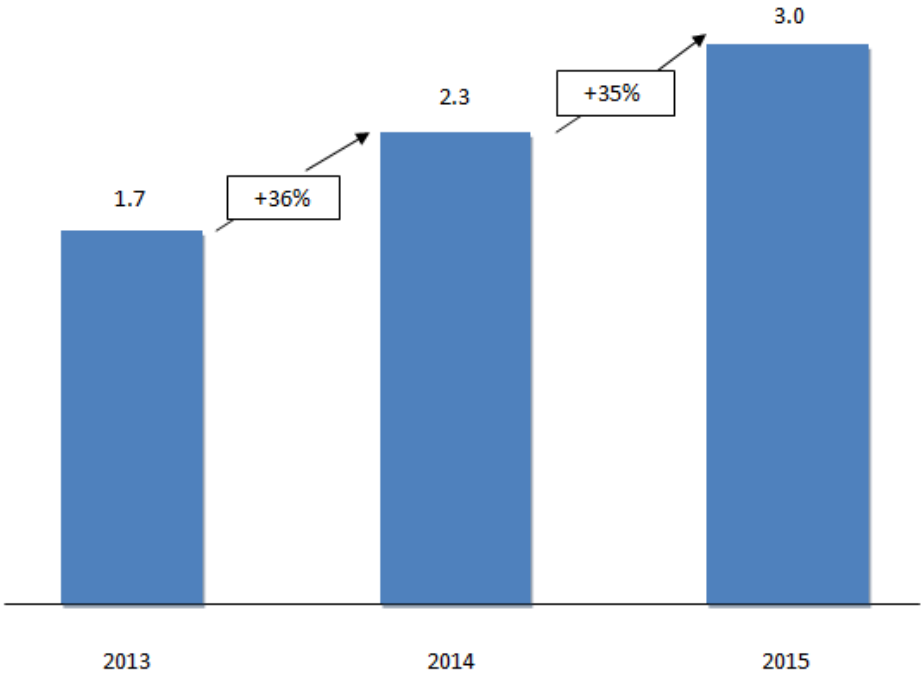

Figure 1.2 the demand for m-health apps is increasing every year (Grad,2002)

Recently it has been seen that of m-health has a great potential to help people in developing countries and conflict many diseases. For example, giving advice to expecting mother and pregnant women via sms or voice massage by using mobile phones are helping them to overcome their health issues.

3.1.1 Scenario in Bangladesh

Bangladesh is a country with the population of approximately 162,894,376 and the area of this country is 147,570 square kilometers. Bangladesh is a over populated country. In world there are some countries that provide free medical services at community level and Bangladesh is one of them. From a literature it has been seen that, currently in Bangladesh there are 593 government hospitals, 467 upzilla and union levels hospitals and secondary and tertiary level hospitals are 126 in numbers. Along with these, there are 2983 private hospitals and 5220 private diagnostic centers are available and working day and night to assure the better health services (Bangladesh,2012).However, Bangladesh has been identified as one of the 57

countries in world that have critical shortage in health workforce. Although, in Bangladesh there are doctors, nurses, midwives number below 2.28 per 1000 population and the number of bed 4 per 10,000 in hospitals (organization, 2012).
Due to poor health care infrastructure and highly dense population it is becoming a challenge for the government to provide adequate and quality health care facilities. To overcome this challenges the government introduced ICT programs in health sector. Due to the Digital Bangladesh campaign of present government it has given more emphasize. As the main objective is to provide special preference to delivery of health care services to citizens is given by ICT programs. In 1998, when the Ministry of Health and Family welfare (MOHFW) took the supervision of Health and Population Sector Programs (HPSP) than first the initiative of e-health programs has taken (Hoque. et al.,2014). But now a day due to present government Digital Bangladesh Campaign it has been given a special emphasize (Hoque., Mazmum., & Bao., 2014).

Not only the government but also the NGOs and private organization started a specific numbers of e-health projects. Along with this the government is trying to improve e-health infrastructure progressively. For example, some initiatives includes, pregnancy care advice via SMS, complaints suggestions via SMS, online population health registry, Geographical Information System (GIS) in health system etc(Hoque. et al., 2014).

In March 2010, Directorate General of Health Services (DGHS) launched a project for pregnant women and expecting mothers of Bangladesh. Through this projects mothers and new born babies will get advice which will help them to improve their health situation. An exciting and effective innovation has been added to the existing e-health complaints and suggestions through SMS. In 800 hospitals in has added how to send complains by SMS in those hospitals display boards. All people visiting those hospitals including patients and their relatives now able to send SMS if they are not satisfies with those services(bennor,2010).

Now a day most of the private hospitals and clinics in Dhaka city are using their own database system for patient's health records. For example, Apollo hospital, Square

hospital, United hospital, Medinova hospital and Popular diagnostic centre are using individual database for each and every patient of them.

The Apollo Hospital Dhaka (AHD) is a combined project of Apollo Hospitals India and STS holdings Limited. They use telehealth in their hospital management system and health care delivery, which helps this institute to create a connection between the patients, their family members, doctors, and clinicians and ultimately it provide them abetter health outcome (Hoque. et al.,2014).

The health information systems of Square Hospital and United Hospital are quite similar. Both the hospitals maintain its own database systems for its patients. This has added a new dimension to the development and communication of both the hospitals. In 2007, Medinova Hospital also started a telemedicine program through which they are able to get experts opinion and support via video conferencing with the physicians in India. Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) has started automation of health services by efficient queue management, evaluation of patients, updated nursing services, integration of laboratory and pharmacy etc (Basher. & Roy.,2011).

NGOs, private organization and mobile phone companies are also providing e-health services to their customers throughout the country. In October 2010, Bangladesh Institute of ICT in Development launched a project called e-clinic as a pilot basis in Shoronkhola, Bagerhat, Kaliyakair and Gazipur. Now it rolled out in 10 other locations (Basher. & Roy.,2011).

Grameen phone, Banglalink and Robi the three different mobile phone operator companies in Bangladesh has launched health link services for its customers for delivering innovative and convenient health care services. The largest mobile operator in Bangladesh Grameen phone has launched m-health services to its customers at a minimal rate per minute. Banglalink also launched health link services to provide its customers innovative and convenient health services. Similar services are also offered by Robi (Hoque. et al.,2014).

D.Net (Development Research Network) is another e-health program which is providing health care services through their telecenters. These telecenters are located

in the rural areas of Bangladesh. It connects the out of reach peoples with its server and communication connection which is located in Dhaka. people can connected to the server simply by using mobile phone (Hoque. et al.,2014).

The e-health project of BRAC, which is named as “Manoshi” also serves peoples at community level. Community health workers gather information and connect it to the headquarters and try to provide those patients better health care services. They mainly emphasize on the expecting mothers and pregnant women (Hoque. et al., 2014; "ICT in Health: Bangladesh Is Moving Ahead,"2012).

In September 2011, the government of USA and Bangladesh launched a telemedicine project under a agreement. This project is named as “Aponjon”. Under the support of Mobile Alliance Maternal Action (MAMA) “Aponjon” provides mobile health services to expecting and new mothers of rural areas in Bangladesh. As this project started with 1500 subscriber on a pilot basis .Moreover, its target is to reach 2 million mothers by end of 2015 (Basher. & Roy.,2011).

3.1.2 Scenario in India

India is a vast country with the population of approximately 1.4 billion and occupying the area of 3,287,268 square kilometers. India is consists of 29 states. To fulfill the basic minimum healthcare level of India’s population which is widely distributed distant geographical locations is main priority of India’s Health Administration (S.K.Mishra, 2015).

In India still there are various work of telemedicine is working on its project mode. Collaboration with state governments Department of Information Technology, Ministry of Health and Family Welfare, Ministry of External Affairs, Indian Space Research Organization (ISRO) are managing telemedicine project in India (S.K.Mishra,2015).

Department of Information Technology (DIT), Ministry of Communication and IT (MCIT), Government of India: The Department of IT is playing a vital role in the implementation of telemedicine in India. They are managing the future of telemedicine applications in India. The DIT has been involved in multiple projects of telehealth. Currently, this department is working on

two different new projects. They are: **Mercury®** and **Sanjeevani®** software by C-DAC. DIT has also sponsored the telemedicine project with the collaboration of state governments. The department is establishing 100 nodes all over India in collaboration with the state governments for better diagnosis and better monitoring of diseases. (S. K. Mishra., Singh., & Chand., 2012).

Indian Space Research Organization (ISRO)is promoting the societal benefit of indigenously developed space technology, under a GRAMSAT (rural satellite) program, in collaboration with state Governments, Indian Satellite System (INSAT) is also linked in these project. Recently, ISRO has established a telemedicine network for 300 hospitals (Ebad., 2013; S. Mishra., Ganapathy., & Bedi., 2008).

State Government is trying to strengthen the healthcare facilities in their states. For this reason the governments of Orissa and Uttarakhand supported the network which is further linked them to Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS) at Lucknow for specialty consultation. The government of Chhattisgarh, Raipur, Bilaspur, Rajasthan, Karnataka and the government of some other region is also linked with the support of ISRO and has established a telemedicine network for providing better health care (S.K.Mishra, 2015).

3.1.3 Scenario in Thailand

Thailand is one of the leading countries in promising and developing the use of ICT application in various insidious including E- health. It has achieved a high level of access of ICTs and ICT skills (Teltscher.,Magpantay.,Gray.,Olaya.,&Vallejo.,2009).

Since 2000, Thailand has a national ICT policy framework and two five years national ICT master plans which the government follows for better care services (Kijsanayotina. et al., 2010; Koanantakool,2006). In the national framework there has e-strategy for e-government, e-education, e-commerce, e-society and e-industry. But e- health strategy is still underdeveloped. For this reason, the country has no national e-health policy and any governmental body to maintain the whole function. As, there is lack of national e-health policy, many e-health applications and services has been developed. Some of them are also implemented.

Moreover, there are few public and private partnerships but the partnership between the Thai Medical Informatics Association (TMI), Ministry of Public Health (MOPH) and public universities has been carried on almost two decades (Kijsanayotina. et al., 2010).

3.1.4 Scenario in Mexico

Mexico is located by United States to the north and Belize and Guatemala to the southeast. The health care sector in Mexico is mainly divided into two major sector. One is public and another one is Private. Although all of these effort the improvements of healthcare sector of Mexico is kind of international. Many countries apply new technologies in Mexico for the betterment of healthcare sector(Eletsonline,2011).

After 2006, it has been identified that incase of Mexican Women those are aged in between fifty to seventy, breast cancer has became one of the leading cause of their death. To overcome this situation Mexican government has taken variety of initiatives. One of the effective initiative to minimize the rate of death was called Opportune Breast Cancer Screening and Diagnosis Programs (OBCSDP), by this innovative development idea of ICT governments set a goal to screen women aged in between fifty to seventy. To identify the problem and to provide them better health care services was one of the main objectives of that project(Ebad.,2013; Edworthy,2001).

There was another challenge which the government of Mexico faced during the e-health related project implementation. That is inadequate internet connectivity in rural areas. To solve this problem, Compact Disc (CD) was used. Those CD carried patient's image and full mammograms. Those CD were also able to transfer patient data and long term data storage feature was also available.

3.1.5 Scenario in Mongolia

Mongolia is located in the central Asia and situated in between China and Russian Federation. The population of Mongolia is approximately 2.8 million (2011) and the area of the country is 1566500 square kilometers. Mongolia is one of the least densely populated countries in the world and the light distribution of population

makes it challenging for the government to distribute quality health care services(Baatar,Suldsuren,Bayanbileg,&Seded,2012). To overcome this situation Mongolian government started a e-health project called telemedicine. The aim of this project was to support the Maternal and Newborn health in remote areas and also to minimize the infant and maternal mortality by reducing the gap between the urban and rural areas health care system in Mongolia. This specific project continued till 2010. This project promotes high risk pregnancy consultations, prenatal ultrasound diagnostics, fetal monitoring and screening and some other reasons.

In 2007, The Government of Luxembourg and United Nation funding for Population Activities (UNFPA) sponsor another telemedicine project in Mongolia to develop the maternal and newborn health and also to support the Government Millennium development Goals (MDG) in the reduction of maternal and newborn health problems (Baatar et al., 2012;"National eHealth Strategy for Mongolia,"2012). Establishment of a fully functional telemedicine network for maternal and newborn health care was the main objective of this project. This specific project also aiming to enable to build a Maternal and Child Healthcare Research Center (MCHRC). That will further able to assist the rural health care providers in delivering quality health care management to remote area populations (Baatar et al.,2012).

3.2 Strength of E- health

Telemedicine has been that support in situations where the health professional on duty has little or no access to expert help. It is able to offer remote physician access to specialist opinions and also provide them encouragement to both doctors and patients. It has been seen that telemedicine programmes either directly or indirectly decrease the number of referrals. Remote care and diagnosis via telemedicine in more economical in developing countries by reducing the distance travelled for specialist care and the related expenses, time, and stress. As a consequence benefits are observed by both the patients and the health care system. Furthermore, telemedicine programmes have the potential to motivate rural practitioners to remain in rural practice through extension of professional support and opportunities for continuing professional development (Kay. et al.,2011).

Telemedicine networks in developing countries can also offer secondary benefits and telecommunication technologies, such as those used in telemedicine initiatives. It has shown to be effective tools for connecting remote sites by opening up new channels for communication. Telemedicine connects rural and remote sites with health-care professionals around the world. By overcoming the geographical barriers and attempting to reverse 'brain drain' or flight of human capital (Puskin., Johnston., & Speedie., 2006). This can lead to increased communication between health service facilities, and facilitate cross-site and inter-country collaboration and networking. Such collaborations can support health-care providers in remote locations through distance learning and training. Telemedicine also provides opportunities for learning and professional development by enabling the provision and dissemination of general information and the remote training of health-care professionals. It is important to note that such partnerships provide mutual benefits. For example, health care providers in developed nations are provided with an opportunity to learn to treat neglected diseases, which they very rarely see in person. The knowledge sharing that occurs as a result of inter-site collaboration may be formal or informal and has shown to aid health-care professionals in overcoming the professional isolation that often face in remote areas (Kay. et al., 2011)

There are some advantages which can provided to the patients by using telemedicine (Osby. et al., 2011),

- Cost efficacy.
- Improving diagnosis accuracy.
- Improved professional education.
- Emergency specialist support.
- Inter hospital access.
- More timely manner care.
- Patient safety reason.
- Privacy assurance.
- More cost effective for patients.
- Improves patient's outcome and satisfaction.
- Convenience.
- Less time in waiting room.

- Making collaboration easier.
- Making larger scale healthcare more efficient.
- Improving rural access to healthcare.
- Telemedicine in military and wars.
- Telemedicine in disasters.
- Bridging the distant gap with remote areas.
- Greater scope for research.

3.3 Weakness of E health

Health professionals similarly have promoted telemedicine as a cost-effective way for patients in developing countries to gain access to basic medical care and the expertise of professionals abroad, which would not be available otherwise. Telemedicine is defined by the World Health Organization as "the delivery of health care services at a distance with the aim of diagnosis, treatment, and prevention of disease and injury by using information and communication technologies (WHO,2007). It has been publicize as a way for patients to gain access to the knowledge of pediatric infectious disease specialists, dermatologists who are capable of diagnosing and treating skin lesions of people living with HIV/AIDS, and orthopedics who are able to examine x-rays from areas where medical infrastructure is not complete. Low-income countries are also able to use telemedicine to overcome limited infrastructure such as inadequate medical facilities, road development by link with health-care providers, specialists, referral hospitals, and tertiary care providers (Puskin. et al., 2006).

Although telemedicine has the potential to greatly improve health care in developing nation's infrastructure but there also remains a provoking obstacle that may eliminate telemedicine as a practical option in many areas. Many developing countries have unstable electric supplies, communication networks, and internet connections outside of urban areas, which make it difficult to transmit data for the purpose of telemedicine consultations and treatment. Even if sufficient technology and communication infrastructure exists to support these programs, patients still need access to actual medical facilities where personnel can transmit patient histories, photographs, and x-rays to physicians abroad. Developing countries must also take

into account other forms of supporting infrastructure that are essential to the administration of treatment (Chowdhury. & Jahan., 2014)

Hospitals and medical facilities will need electricity and clean water to conduct the prescribed medical procedures, doctors will need developed roadways to travel to patients at home and administer medication, and patients will need safe and stable housing if someone is being treated for diseases and conditions make worse by lack of clean water, plumbing, or the presence of mold(Ciancio,2009). The diagnoses and recommendations secured from experts will do little good for them. If developing nations do not address the underlying infrastructure deficiencies prohibiting effective treatment then, the desire for telemedicine may remain premature. Even though telemedicine is aimed at overcoming the lack of medical infrastructure in underdeveloped areas, the reality remains that without supporting infrastructure telemedicine solutions it will likely be ineffective (Ciancio,2009).

Even though telemedicine is aimed at overcoming lack of medical infrastructure in underdeveloped areas, the reality remains that without supporting infrastructure, telemedicine solutions will likely be unsuccessful.

- Inadequate ICT infrastructure, there is no proper infrastructure for ICT.
- Remove humanistic quality from medicine.
- Physician resistance.
- Inadequate assessment.
- Collapse in the relationship between health professional and patient.
- Cultural misunderstanding.
- High operating cost.
- High cost of band width.
- Legal and competing priorities as barrier in the domain of telemedicine.
- Reliability issues of the patent.
- Computer illiteracy, weakness, Phobia.
- Unavailability to data transfer connectivity.
- Lack of policy and regulation.

3.4 Recommendations

Telemedicine has many advantages and a bright future. It has various potential to improve its application and develop the health care sector of developing countries. For this reason, research should be done continuously. In order to improve health care quality for patients in remote areas of developing countries health application are widely needed which will save both the time and money of the patient.

In developed countries the access of m-health is more than developing countries. So, in developing countries this approach need to improve. From a report of it has been found that, a high level of mobile telemedicine activity was reported among participating Member States in the Americas (75%), European (64%) and South-East Asia (62%) Regions and the countries in the high-income group reported the highest percentage of mobile initiatives (64%) followed by lower-middle income countries (53%) (WHO, m-health report, volume3,2013).

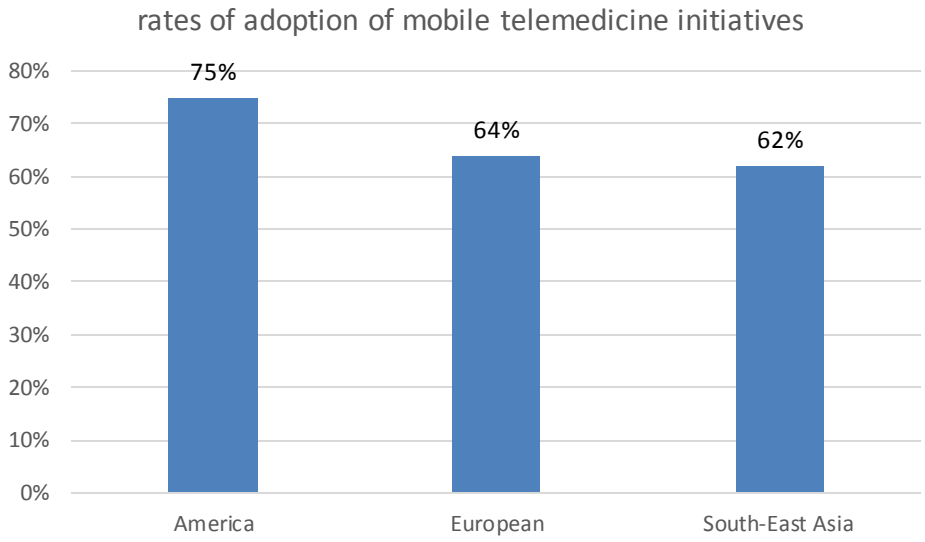

Figure 1.3 Rates of adoption of mobile telemedicine initiatives

For better telemedicine and e-health program first the assurance of good quality and connectivity of internet and communication networks is needed because without any internet connection there will be no telemedicine. So, Internet and its connection is one of the main sectors where improvement needs to be done. In case of whose projects which are running currently internet is a mandatory

element for them. If the internet connection is good, then the patients will be able to get proper treatment from the physician at correct time. Patients can also get necessary suggestion from the physician via teleconsultation. If there will be poor connectivity of internet then patients will suffer in case of teleconsultation and won't be able to send or receive any important documents related to their health issues (Altman., & Davie.,2000).

As the main focus is on the implementation of telemedicine especially in rural and remote areas, but still there are many places in rural areas where communication networks is unavailable and if there is internet connection that is very weak. So, this sector needs major improvement or else it will be difficult to transmit data for the propose of consultation and treatment such as, access to patients medical histories, photography ,X- ray and Ultra sonogram reports by physicians who are in abroad or urban areas (Nessa., Ameen., Ullah., & Kwak., 2009).

Another most important thing is that the telemedicine center need 24 hours supplement of electricity because without electricity telemedicine program is unworkable. In case of urban areas there are less electricity problems then rural areas which need to solve. In Bangladesh, there are many remote areas where still there is no connection of electricity. Hence, the government needs to pay more attention on this side to improve the health care sector of the country.

Another matter which needs to improve is that cultural misunderstanding among people. There is a misunderstanding among people is that without self observation or face to face consultation diagnosis of the disease is not possible, which is completely wrong idea. Some people also think that if any document or report is provided on telemedicine application via internet it will go viral and those information won't be secured. The misconception need to be removed. Information and documents on telemedicine is more secure than hand to hand delivery because, on normal delivery process documents can get misplaced and people can lose the important information. But on telemedicine those information will always remain safe and secure within a secure pass code and without code no one will be able to access them. So, for successful implementation of telemedicine people need to change their traditional mindset.

3.5 Future Trajectories for Developing Countries

At first to provide the health facilities, health workers and community clinics, appropriate devices and Internet connectivity are being delivered to these facilities aimed to be completed by 2016.Making a permanent online Electronic Health Records (EHR) of all citizens of Bangladesh is now on progress. The goal of maintaining integrated health record for a patient is to enable care providers to improve their service quality. The project included the rural citizens, who represent 76% of the country's population ("E-governance in Hospital : A Review on Global and Country Situation," 2015).With the each passing day advancement of technology is happening. So, with the advancement of technology e-health will be more upgraded and updated

Handheld Telemedicine Kit, Some organization is planning to release a smallest mobile telemedicine kit on the market. The Handheld Telemedicine Kit will includes the medical devices needed to conduct first-line patient exams, integrated with a tablet computer device in the kit allow the advantage of the latest advances in optics, LED light sources, digital displays, wireless data transfer and high-resolution imaging to interface with EHR and A picture archiving and communication system (PACS) systems. The kit will also be able to work with mobile applications (Medweb,2014).

PhysioGlove, getting an accurate 12-lead ECG can be awkward if there are no trained technician available who don't know where to place the electrodes. Sometimes leads can also fall off or get disconnected when patients move around. In that case, the PhysioGlove strives to eliminate that problem with a wire-free, simultaneous and fully diagnostic 12-lead ECG recording system. It can give accurate ECG that can provide life-saving information in a very timely manner (commonwell, 2014).

Telemedicine Robot, local hospital can integrate a robot with medical qualifications. This telemedicine robot will also able to combines telecommunications and Auto Drive technologies. Hospitals and telemedicine center can integrate this type of robot into telestroke, teleICU, telepsych and telepediatric programs. Robotic telemedicine solutions will provide a new level

of ease of use and independence that frees doctors and nurses to focus solely on patient care and to forget about the technology (Congdon, 2012).

CHAPTER: 4

CONCLUSION

The development of healthcare systems are the most obvious thing in developing countries and in the revolution e-health will play a essential role because it will make the health system more easier and accessible for patients who are in distant location. As, it is the era of technology, so the future of the telemedicine will expand a lot more. Utilizing the technology appropriately and cost-effective solutions that are sensitive to the reality of the poverty is one of the most important advantage people are getting from telemedicine (Vo., Farr., & Raimer., 2011). Such advances cannot be achieved through technological imperative approaches. It requires a structured approach in the course of the development of synergistic e-health strategy at the national, sub national, and facility levels to guide public and private innovation, and broad user adoption. In conclusion, it can be assumed that this comparative study will help to bring out the strength and drawbacks of existing e-health projects in developing countries. Other developing countries or future e-health projects can take learning from this when needed.

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