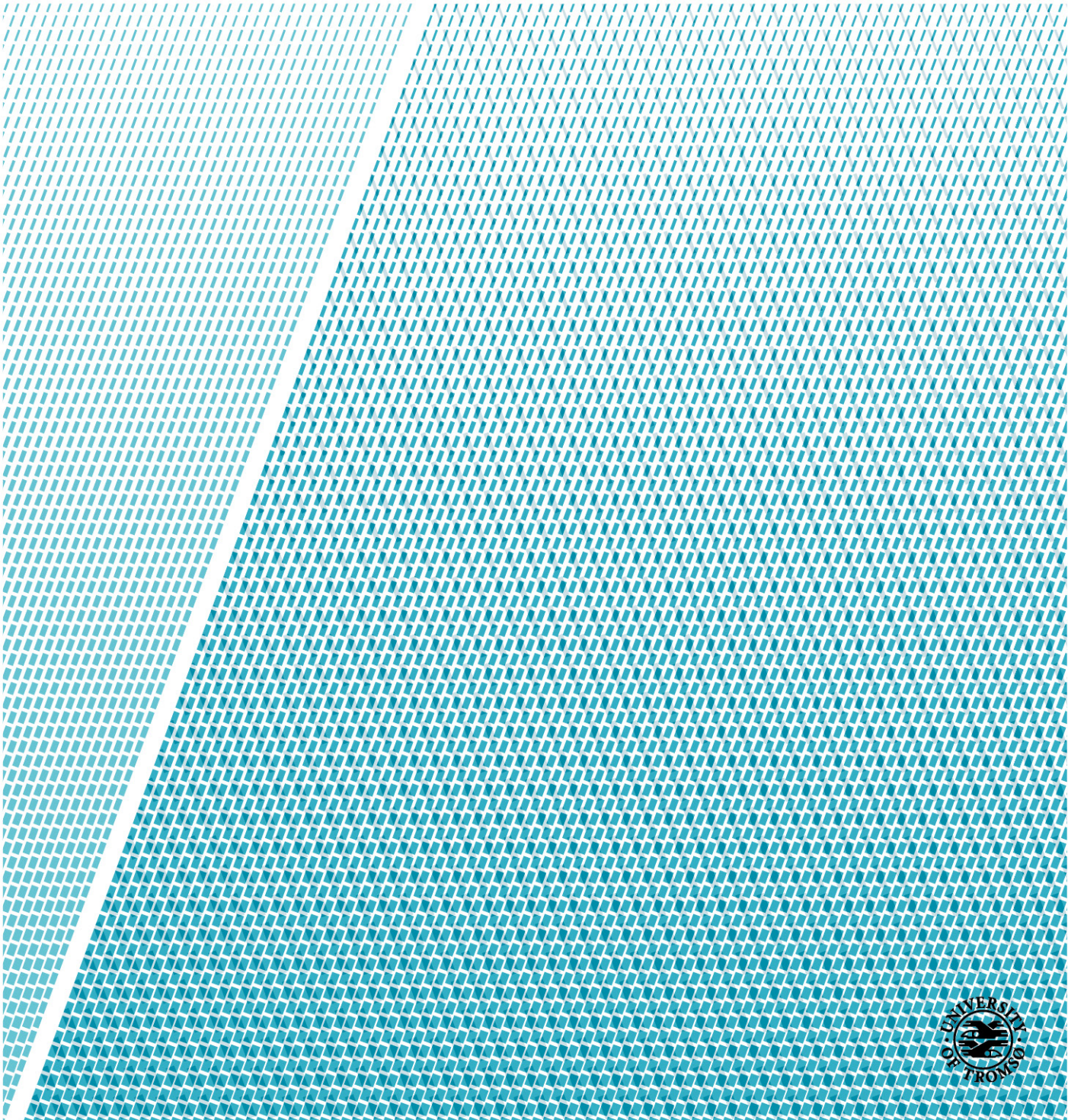Department of Clinical Medicine

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Impact and Challenges of M-health Application
A Study in Rural Nepal

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Abstract

Background: Telemedicine is the use of information and communication technologies to provide healthcare services when the participants- the healthcare professional and patients are in different locations. It does not denote a separate medical method, rather it represents the tools that can be applied by health professionals to extend their services to the people living in distance.

The present study has critically examined Medic Mobiles' m-health program on health of pregnant women in Baglung. It has specifically highlighted how m-health program operated by Medic Mobile in rural municipalities have reduced maternal and child mortality, and how Community Health Workers (CHWs) involvement on m-health programs have contributed to improve obstetric care.

Methodology: This study is based on qualitative research method. Sixteen semi-structure interviews, two focus group discussions and field observation were conducted in Baglung. Socio-technical theory and infrastructural theory have been applied as theoretical lens to understand the impact of mobile health on obstetric care.

Results: The findings of the study articulate that implementation of Medic Mobile program has positively impacted on women and neonatal health in rural municipalities of Baglung. CHWs frequent visit has encouraged women to discuss about their health issues. Moreover, instead of visiting traditional healers, more and more women in Baglung have started consulting health professionals. Women's status at house has been improved as they have started participating in household and community decision making. Men are more concerned about the health of wife and children. However, implementation of Medic Mobile program is still facing many challenges such as lack of good infrastructure, patriarchal socio-cultural values, lack of human resources and budget.

Conclusion: In Nepali medical sector, telemedicine has played an important role to bridge the gap between cities and rural areas. More specifically, it has been proved as a beneficial tool to support for a wider section of the people living in rural areas, who are suffering from inadequate infrastructure and lack of specialist healthcare.

Key Words: Telemedicine, Medic Mobile, Community Health Worker, Mobile Health.

Acknowledgement

List of Abbreviations

ANC   - Antenatal Care

CDS   - Clinical Decision Support

CHWs - Community Health Workers

DALY - Disability Adjusted Life Year

DHS   - Demographic Health Survey

EPR   - Electronic Patient Records

FCHVs- Female Community Health Volunteers

FGDs - Focus Group Discussion

FHD   - Family Health Division

GNPs - Gross National Products

GoN   – Government of Nepal

GPRS - General Packet Radio Service

ICT   - Information and Communication Technology

IDIs   - In-depth Interviews

II   - Information Infrastructure

INGOs - International Non-governmental Organizations

IT   - Information Technology

LMIC   – Low-and-Middle Income Countries

MDG   -   Millennium Development Goals

MMR - Maternal Mortality Rates

MNH   - Maternal and Neonatal Health

MoH   - Ministry of Health

MoHP – Ministry of Health and Population

NFHS - Nepal Family Health Survey

NGOs - Non-governmental Organizations

PCIS   - Patient Care Information System

PDAs   – Personal Digital Assistants

PNC   - Postnatal Care

PSI   - Population Services International

R&D   - Research and Development

SBAs   - Skilled Birth Attendants

SDG 3 - Sustainable Development Goals 3

SMP   - Safe Motherhood Policy

SMS   - Short Messaging Service

SWAP - Sector Wide Approach

TB   - Tuberculosis

TBAs   - Traditional Birth Attendants

TM   - Telemedicine

UNICEF – United Nations International Children's Fund

USAID – United States Agency for International Development

WHO   - World Health Organization

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CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Nepal is a geographically diverse and land locked country situated in between two giant economy - India and China. About 68 per cent of total area lies in mountain and hill. Population living in high hill mountains and southern plains are disadvantaged due to lack of basic infrastructure, extreme climate and harsh geography (Kafle 2015). Nepal has gone through significant political changes. Political instability has been affecting socio-economic development. Within a span of 30 years, Nepal has had 13 different governments. It has witnessed significant socio-political transition following movement for democracy in 1990s, a decade long arm conflict that ended in 2006 with the comprehensive peace agreement, and other subsequent conflicts that have overshadowed socio-economic as well as infrastructural development of the country. More than 80 per cent population of Nepal live in rural areas, but people living in western and far western mountains and southern plain are suffering from lack of access to basic facilities. Social structures are based on traditional, conservative patriarchal values where women are confined into household chores (Panday, Bissell et al. 2017). Acute shortage of doctors and other health personnel, hospitals with basic facilities are common destiny of people living in rural areas.

In a developing country like Nepal, people pursue healthcare services in two different ways. In urban areas, people go to the hospitals and follow doctor's prescription, but people in rural villages still believe and seek traditional ways of healing known as "faith healing". Due to lack of proper infrastructure development, resources constrained or management loopholes, modern healthcare facilities have been confined in city areas, and rural areas still face lack of proper healthcare facilities (Gurung 2016).

To fulfill this gap, the government of Nepal formulated National Health Policy (1990) which in 1997 was replaced by second Long Term Health Plan (1997-2017) that mainly focused *"on improving the health status of women and children, poor, underprivileged and marginalized population living in the rural areas"* (Ministry of Health 2017). The newly promulgated Constitution of Nepal has also recognized health as fundamental human right, which emphasizes on *"equitable access to health services and right to get basic health services free of cost. The constitution also guarantees that every citizen shall have right to*

get information about their health care" (Ministry of Health 2017). The five yeas periodic plan in health started in 2005 which had introduced Sector Wide Approach (SWAP) which made incremental progress in e-Health in Nepal. Now, the government agencies, non-governmental organizations and the private sectors have been involved in telemedicine programs in Nepal.

Several scholars have presented different definition of telemedicine. Here I articulate the definition presented by World Health Organization (WHO, 2009) as *"the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care provider, all in the interests of advancing the health of individuals and their communities"*(Ryu 2012).

From the above mentioned definition, relevance of telemedicine is more evident in distance whenever the geographical situation impairs care and treatment to be delivered to a patient (Combi, Pozzani et al. 2016). Everywhere, distance and geographical harshness may affect the delivery of health services in both time and the quality of service. Further, telemedicine in a simple term can be defined as the use of any means of information and communication technologies for the treatment of the patients (Combi, Pozzani et al. 2016). It is not only for the treatment of patients in remote areas or diagnosing a patient through remote monitoring rather it is also about e-learning techniques and teleconsultation services. It refers the consultations between doctors to patients, or between doctors and any other health professionals through a network such as internet, skype, messenger (Bhatta, Aryal et al. 2015).

In developed countries, several telemedicine projects and programs have been implemented which have brought the good outcomes (Combi, Pozzani et al. 2016). But in the developing countries like Nepal the effectiveness of intervention of telemedicine technology has been limited probably this is because of limited budget available, smaller return of investment, lack of modern technology and infrastructures (Bhatta, Aryal et al. 2015). Further, *"while telemedicine programs in developed countries in most cases may easily deploy an emergency strategy, such as sending out an helicopter to rescue the patient and to transfer him/her to the*

nearest hospital in a very short time, similar situations in developing countries are generally more expensive and much harder to be deployed" (Combi, Pozzani et al. 2016) . In developed countries telemedicine is an alternative of conventional healthcare, it goes side-by-side of conventional healthcare. But in developing countries sometimes telemedicine becomes only one alternative. (Combi, Pozzani et al. 2016). In Nepal, application of telemedicine technology could be the means to serve wide remote population with primary health services and to narrow down the distance between big specialized hospitals and rural areas (Bhatta, Aryal et al. 2015, Combi, Pozzani et al. 2016).

1.2 ICT and Healthcare in Nepal

Telemedicine is a method of healthcare services in rural areas where information related to health is transferred and disseminated through the medium of telecommunication such as mobile, telephone, internet (Bhatta, Aryal et al. 2015). A country like Nepal where there large number of population in rural areas are suffering from inadequate infrastructure and health professional, telemedicine is an effective methods to provide health care services to underserved rural population (Rai 2013).

Telemedicine seems to be an effective means to ensure basic healthcare to rural population and distance areas (Combi, Pozzani et al. 2016). Since, through telemedicine technology it provides virtual presence of specialist at local healthcare centers where the local health care workers can discuss, take advice of specialists of hospitals in big cities and deal with the patient's complications accordingly (Pradhan 2005). Further, via telemedicine technology the specialist health professionals can train remotely located health workers that ultimately helps to narrow down the technological and professional gaps (Bhatta, Aryal et al. 2015).

In order to provide quality health care services to the rural population, the government of Nepal, non-governmental organizations and other stakeholders have implemented various projects in Nepal. In 2004, with the financial support of ICT R&D Grants Program for Asia, Healthnet Nepal started a pilot project of telemedicine in Nepal. The main objective of the project was to test the potential of telemedicine. The project was lasted for 2 years which had conducted programs in the eastern, the central and the western region of Nepal (Pradhan 2005). The finding of the project was that there was not huge difference between the diagnosis through conventional and the telemedicine method (Pradhan 2005). But they

emphasize on the training of healthcare professional and enhancement of their competence about telemedicine technology (Rai 2013).

In 2004, with the collaboration of Apollo Hospital in India Om Hospital and Research Center, a renowned private hospital in Kathmandu Nepal started telemedicine program in Nepal (Piya 2010). The doctors and other specialists in both hospitals were able to discuss and share relevant health issues, treatment plans. Similarly, in order to provide quality healthcare to the population in distance Dhulikhel hospital also started telemedicine service. Initially, the Dhulikhel hospital started a walkie-talkie Radio-Based Communication System in two rural health centers in Bhunipati and Phediche which was also available in ambulance (Rai 2013).

In 2011, the Ministry of Health and Population with the collaboration with Patan Hospital initiated telemedicine program. The project was connected Patan Hospital with other twenty five regional and district hospitals across the country (Rai 2013). In 2012, the government further connected 5 more district hospitals (Bhatta 2015). The patients in the regional and local hospitals can ask their health-related queries to the specialist doctors. Recently, the telemedicine service of government of Nepal follow three different methods, a) telephone-based consultation through toll-free number. The public may contact to the specialists to get advice. b) Video Conferencing: regional and district hospitals are connected to video conferencing where patients get opportunities to consult health related issues; and c) store and forward method: medical support is provided with the support of online portal. In this method the healthcare professionals in the district hospitals details of patients to the specialists in the central hospital and the specialists replies with necessary feedback and suggestions (Bhatta 2015). Currently besides government hospitals in Kathmandu several private hospitals such as Model Hospital, Manipal Hospital, Tilganga Hospital, Institute of Medicine, Manmohan Memorial Community Hospital etc. as well as several NGOs and INGOs have been operating telemedicine programs targeting to the people in remote areas.

1.3 Community Health Workers (CHWs) and Maternity Care in Nepal

With the goal of reducing maternal and child mortality and improving the family health, in 1980s Nepal started female community health volunteers program known as "Mahila Swoyemsewika" which means "female Volunteer" (Kandel and Lamichhane 2019). Initially

their role was to support family planning programs such as distributing condoms, birth control pills etc., however their role were gradually expanded in other programs (Unicef 2004).

Community health workers are behind the significant reduction of child and maternal mortality in Nepal (Unicef 2004). There are more than 50 thousand community health worker who are continuously working to aware and educate villagers through various health promotional activities such as "*sanitation, nutrition, family planning, HIV, and maternal and child health; health service (family planning, deworming, polio campaign and integrated management of childhood illness); and collecting and reporting demographic data to an intermediary in the community"(*Kandel and Lamichhane 2019*)*.

Nepal is a developing country with low per capita income, low literacy rate, significant segment of the population suffering from lack of basic healthcare services. Since 1996 to 2006 Nepal witnessed civil war in which about 17 thousand people had lost their lives and millions were affected (Kafle 2015). Despite all above mentioned unfavorable circumstances health indicators in Nepal are significantly better than other many developing countries, the credit mostly goes to the community health workers (Panday, Bissell et al. 2017). Their selfless volunteer work to the community health programs like family planning, vaccination, helping women to delivery are behind the significant reduction of maternal and child mortality in Nepal (Kandel and Lamichhane 2019).

Communities in rural Nepal are conservative; social structures are based on patriarchal values; women are basically restricted to the childbearing and household chores (Khatri and Karkee 2018). Despite this paradoxical social values community health volunteers are usually very busy. On the one hand, they have to maintain their daily responsibilities to their family and business, and on the other hand they participate in different community health related programs, attending meeting and call, participating in the training (Unicef 2004).

Being a member of local community, community health workers are aware about locally established norms (Khatri and Karkee 2018). They know each member of every household who needs health care, who need vaccination; when needs they make house-to house visit, discuss with the family members and discuss on various health related issues (Maru, Nirola et

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al. 2018). In Nepal, community health works are always in front line during the emergency situations. For example, during the disastrous 2015 earthquake, community health workers were on the front line. They were counselling to the victims and provided psychological support to prevent post disaster trauma. Most importantly, local people trust community health workers and they are more open to share their feelings which is most crucial for community health (Kandel and Lamichhane 2019).

1.4 Motivation of the Study

In Nepal, despite gradual progress in poverty reduction, political and socio-economic equalities in recent decades, rural people are still suffering from lack of quality health care services. There are huge disparities between rural and urban areas. The hospitals with specialist are mostly located in capital and other big cities. On the one hand, government hospitals located in capital and district headquarter are overburdened, and healthcare centers in rural areas are poorly equipped with acute shortages of doctors and other healthcare professionals. On the other hand, private hospitals in the capital and other big cities are very expensive; the rural people cannot afford that. It is not surprising to read news of people dying due to the lack of access to basic healthcare services.

Children and pregnant women in rural areas are more affected. The situation is even worse in province 2, mid and far western hills and mountains where due to patriarchal values women are not free to decision making. The harsh topography, lack of good health care centers in community as well as traditional beliefs compel people to seek witchdoctors instead of visiting to a hospital. More importantly, the government, NGOs, INGOs and private sectors have been investing huge resources, but the fate of women in rural villages has not changed much.

This thesis is the result of my own experience. As I grew up in remote where I had witnessed many cases of people suffering from healthcare issues. Due to lack of healthcare center women were compel to delivery their babies at home, people suffering from miner health issues had to suffer for long. To fulfill my quest of quality education in medicine, later I went to India for further studies and completed my bachelor's degree in pharmacy, where I got new opportunities to learn different perspectives and practices in health care services. While studying master in Telemedicine at UiT, participation in course activities as well as

discussion with my professors and fellow students strike my childhood memories. Therefore, it is my personal interest to examine the impacts of telemedicine programs on women and children in rural Nepal.

1.5 Statement of the Study

This study focuses on the role of m-health on improvement of obstetric care. It is about women's access to m-health technology to care about their health during the pregnancy. It tries to explore the current scenario of implementation of m-health application in Baglung. This study particularly focuses on impacts on women's lifestyle; challenges and the opportunities of the implementation of Medic Mobile projects in rural municipalities of Baglung.

1.6 Research Question

The objective of the study is to get better understanding of the relationship between pregnant women's access to telemedicine technology and changes in their health, lifestyle as well as status in family and in community. To fulfill the objective of the study and to give right direction to the research following research questions have been formulated.

a. What is the purpose of Medic Mobile project in Baglung?
b. How do the women use Medic Mobile's health application for obstetric care?
c. What are the opportunities and challenges of implementation of Medic Mobile projects?
d. What are Community Health Workers (CHWs) as well as other health professional's reflection on Medic Mobile programs?

1.7 Structure of the Study

This thesis is divided into 7 chapters. After the introduction of the study, the chapter 2 outlines the theoretical framework of the study. Chapter 3 is about the research setting. Chapter 4 presents the methodological outline of the study. Chapter 5 presents the case study. Chapter 6 focuses on discussion and analysis. Summary, conclusion and recommendation are presented in chapter 7.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 Introduction

In low-income nations and in areas with constrained foundation, telemedicine applications are basically used to connect human services suppliers with experts, referral clinics, and tertiary care (Sowter, Astin et al. 2016). Many developed countries, including the United States, have made it a need to join telemedicine into their medicinal services frameworks (Rao 2009). Despite the fact that minimal effort telemedicine applications have turned out to be practical, clinically valuable, reasonable, and versatile in such settings and underserved networks, these applications are not being embraced on a noteworthy scale because of an assortment of obstructions (Sowter, Astin et al. 2016).

Around the world, this idea has been received by nations in exertion to give better human services to those in provincial territories where doctor's facilities might be at a separation and experts might be considerably more remote (Rao 2009). Telemedicine is simply not just for remote checking or diagnosing a patient, it likewise incorporates e-learning strategies (to remotely convey training both to social insurance laborers and to patients), and teleconsultation (otherwise known as tele counseling or experts second counsel) facilities (Daly, Horey et al. 2017).

Vanessa saliba et.al describes telemedicine across borders as the conveyance of health care services at a distance, including at least two countries, utilizing data and information technologies (Saliba, Legido-Quigley et al. 2012). The health professionals can communicate with the patient faster as well as with the colleagues at distances directly. It has shown its impact on the developing world than the developed ones (Edworthy 2001).

According to Richard Wootton, telemedicine is used to solve certain kind of health problems in the developing world. It can be used in three major categories as clinical, educational and administrative (Wootton 2001). Yet, financing is a challenge for the developing countries (Wright 2003). Although, telemedicine will not help in the infrastructural problems of the developing countries like sanitation and hygiene (Wootton 2001).

Nora Eccles study on telemedicine in developing countries says that telemedicine may reduce the physical barriers to the health services (Eccles 2012). Telehealth projects have been going on in both developed and developing countries but still there are lack of evidences (Scott and Mars 2015). Developing countries cannot afford high cost of telemedicine program still has a few success stories of the pilot projects at low cost. It should follow an adoption from a small project to pilot project to have telemedicine program (Alajmi, Almansour et al. 2013). The future of telemedicine depends on the human factors, economic and technology. The growth of information technology will help the patients and provider in health care systems in future (Heinzelmann, Lugn et al. 2005).

Heinzelmann PJ et.al states that telemedicine can be an alternative to the conventional method of health care and can improve the clinical outcomes (Heinzelmann, Lugn et al. 2005). In the present situation, telemedicine has been used for patient care but still there are less evidence but in the near future it can be a basic tool for the diagnosis and assistance of the patients in the remote as well as urban area (Morosini 2006).

Telemedicine in developing countries can help in accessing the secondary benefits. It can also help in providing general training and information in the remote areas health care professionals (Organization 2010). Telemedicine program are still in the initial stages in the developing countries. There need to be further studies focusing on the main issues of the countries (Alajmi, Almansour et al. 2013).

Mobile phones are considered a part of telemedicine. The mobile health applications have been widely used as a telemedicine. The utilization of mobile phones is rapidly growing as the development of new technologies. Thus, m-health has growing its market value along with its usability. The use of mobile phones in the health care systems improves the communication between the patient and the health care professionals as well as provides different information regarding different aspects of health care services (2017). Ministry of Health (MoH) in Nepal has put efforts to expand m-health and e-health program in healthcare services especially in rural communities where it is difficult to maintain health facilities (2017).

According to WHO (World Health Organization); *m-health is defined as a medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs) and other wireless devices. M-health involves use and capitalization on the mobile phone's core utility of voice and short messaging service (SMS) as well as more complex functionalities and applications including general packet radio service (GPRS), third and fourth generation mobile telecommunications (3G and 4G system), global positioning system (GPS) and Bluetooth technology* (WHO 2011).

According to International Telecommunication Union, *there are now close to 5 billion mobile phone subscriptions in the world, with over 85% of world's population are now covered by a commercial wireless signal* (WHO 2011). According to Brahima Sanou (2015), *Globally 3.2 people are using internet of which 2 billion are from developing countries* (Sanou 2015).

With the use of Information Technology (IT) Infrastructure and mobile phones, individuals from remote areas can gain and share information online instead of travelling long distance to health care centres. This system improves access to healthcare through maps, images and data provided in the mobile phone (Shrestha 2014). Moreover, m-health changes daily workload and improve the health status of the individuals and health professionals unlike questions arise as how this application will improve the daily life of the individuals in remote areas including the remote health care centres.

The utilization of Information technology (IT) in health care services has been turned out as a pioneering innovation facilitating governmental and non-governmental organization working for the people living in the remote and difficult geography (Shrestha 2014). It is a basic tool for financial and social advancement of the country helping those apprehensive framework of unpredictable societies, transmitting and transforming data and commands around the different parts for such social orders (Shrestha 2014).

The growth of mobile phones utilization is growing rapidly and so is the development of new technologies. Thus, m-health has growing its market value along with its usability. The use of mobile phones in the health care systems improves the communication between the patient and the health care professionals as well as can provide different information regarding

different aspects of health care services. Ministry of Health (MoH) in Nepal has put efforts to expand m-health and e-health program in healthcare services especially in rural communities where it is difficult to maintain health facilities (2017).

With the use of IT infrastructure and mobile phones, individuals from remote areas can gain and share information online instead of travelling long distance to health care centres. This system improves access to healthcare through maps, images and data provided in the mobile phones (Shrestha 2014). Despite this, m-health changes daily workload and improve the health status of the individuals and health professionals unlike questions arise as how this application will improve the daily life of the individuals in remote areas including the remote health care centres.

2.2 Use of telemedicine

2.2.1 To get support in healthcare

The advanced and recent telemedicine technology had enhanced the decision-support system for the healthcare professionals. In order to develop and make success to telemedicine one should accept and face the challenges during the process including user acceptance (Chau and Hu 2002). Telecommunications has been used to bring change in the healthcare sector. These technologies help in gaining access to patients in rural areas and help in exchange of health information (Eren, Subasi et al. 2008).

Recently technology has advanced, and we can access these technologies in different forms. Similarly, mobile phones have emerged in these few years drastically. Nowadays, there are a least number of people without mobile phones.

Video conferencing, internet facilities and telecommunications has already started for the delivery of healthcare services (Angaran 1999). This is a rapid change in the context of developing countries like Nepal. There has been rapid development of telemedicine in order to provide healthcare services in rural and remote areas (Laouyane 1998).

Telemedicine has been widely used in the field of healthcare and therefore, many mobile health applications has been implemented to give the basic healthcare facilities to the people. These mobile applications are slowly reducing the barriers and improves the remote

diagnosis and information transfer of the patient to the healthcare facilities (Silva, Lopes et al. 2011).

2.2.2 To explore more about mobile health applications

Mobile health applications help to collect and deliver data and information. Applications are growing than the traditional telemedicine program due to flexibility in smartphone, cost-effectiveness and many more (Sama, Eapen et al. 2014). The lack of availability in frequent health monitoring is a major drawback in healthcare system. Mobile phones and wireless networks nowadays help in reducing such barriers in healthcare. Mobile health purposes to deliver healthcare anywhere, anytime even with organizational barriers improving the data accuracy, remote diagnosis, patient information transfer (Silva, Lopes et al. 2011).

Telemedicine program has been implemented by various institution as a pilot project in developing countries. Similar project like Medic Mobile and Population Services International (PSI), Nepal has been implemented in order to create awareness program in relation to birth control pills. These projects have also shown to take an initiative in improving the healthcare in Nepal. This project has shown to reduce the neonatal birth rate.

With the distance medicine program, there comes diversity in diseases in rural and remote areas, healthcare and outcomes. Technological and cultural barriers tend to extend telemedicine programs with little gains (Edworthy 2001).

Most of the time telemedicine in healthcare is used for educational purposes. Telemedicine can be used in educating health workers and patients (Wootton 2001). Health information can be gained from online resources, print, computer-based resources, health organizations. They can provide information to the consumers and guide them (Nicholson, Grason et al. 2003). Most of the people who care for their loved ones nowadays use social networking sites to gain health information. Internet is best used to collect all health related information (Fox 2011).

2.2.3 Women access to mobile health applications

According to Parajuli et al. (2017), women and girls in rural Nepal are more likely involve themselves in telemedicine program. They are involved with mobile health and has been

gaining health information through doctors and health workers. They even try to exchange the health information to their family members and health workers. Video-conferencing is well accepted by women and girls in rural Nepal (Parajuli and Doneys 2017). Telemedicine is known to deliver the healthcare to rural and remote areas and exchange the health information using information technology and telecommunications (Ferguson, Doarn et al. 1995). The exchange of information is what people in rural Nepal needed the most.

Gender inequalities is one of the major factors for the declination of maternal health. The restrictions faced by a young woman in the family during the pregnancy is the problem in developing countries like Nepal (Furuta and Salway 2006). Older women in the family takes the decision for the young women and gaining the health information regarding pregnancy state is thought to be 'shameful' by the community (Furuta and Salway 2006). Males are often involved themselves in primary decision-making process and restrict the women in visiting health care professionals (Luitel 2001).

It is only the basic installed base in one part of the country. But there are many who does not know anything about telemedicine and what are its benefits. There are various plans and policies regarding health issues in Nepal, but none of them are in practice. Lack of infrastructure has always been an issue in any kind of project of the government. Telemedicine should be known around the country and should be used to gain the benefits from it in development.

Telemedicine is a need in developing countries like Nepal. Low infrastructure, limited health facilities, limited healthcare professionals leads to the need of telemedicine services specifically to the remote and rural areas of Nepal (Shrestha and Ellingsen). Improving the accessibility, quality, efficacy of the health care services is the most important part of telemedicine program. Lack of coordination from the Government, financial ability come up with the challenge of implementing telemedicine in rural Nepal (Bhatta, Aryal et al. 2015).

2.3 Socio-technical theory

Berg (1999) says that the term socio-technical approach is heterogeneous networks in the health care practices. It forms a network of people, tools, organizational routines, documents and so for. For the evaluation and developing IT applications in health care system mainly

two different types of approach are introduced. Firstly, establishing such approach, it appears to be politically difficult process as users must be centralized and secondly, socio-technical approach seems to visualize the roles of IT system in health care services.

To understand the mobile health technologies and the broadband connections, the interrelationships between the technology and socio-technical approach should be interrelated and appropriate (Sawyer, Allen et al. 2003). The mobile health application implemented by the Medic Mobile has been the change and continuity of the socio-technical approach. The new telemedicine implementation have helped the system designers to make user friendly application and involve the users in the design process (Mumford 2006).

M. Berg and E. Goorman says, *"successful sociotechnical design of information system in health care starts with thorough understanding of the practices in which they are planned to function."* They also state about the problems that arise while designing the information system related to electronic patient records (EPR) from a socio-technical perspective (Berg and Goorman 1999).

Designing an information system is not easy and to overcome the problems one should have a clear understanding about the work for which the system is designed (Berg 1999). From a socio-technical view, frameworks supporting clinical procedures will pretty much move past hierarchical outskirts, which makes it hard to separate the framework from different parts of changes (Bente Christensen 2014).

The designing of mobile health application, an information system from Medic Mobile, must have a clear understanding about the application from user perspective to which it has been designed. Medic Mobile installed base has tried to reach the goal of reducing maternal and child mortality through *SafeSIM* with simple design infrastructure improving health status.

M. Aenestad and T. Jensen tell us that nation-wide information infrastructure in health care practice has often failed to reach their goals. The view of installed base discussed in the literature is socio-technical as well as practice-oriented including the social and physical framework of technologies and routines. But there is a challenge that while implementing the new infrastructure in a system, it should match with the old one as well.

While designing an IT system there might be some design problems as bootstrap and adaptability. To avoid such problems there are some steps like making IT system as simple as possible, separating different layers of infrastructure, generating positive networks, and making a solution of a problem targeting the users need (Aanestad and Jensen 2011).

Berg also says that the influence of users in the development of information infrastructure cannot be underrated as implementation of these technologies should account in both the technical as well as the social aspects. These terms should be interrelated with each other since designing and working on the infrastructures in socio-technical approach is problematic (Berg 1999).

2.4 Information Infrastructural (II) Theory

The term infrastructure has been utilized within connection to data innovation organization to signify fundamental backing frameworks like operating systems, record servers, correspondence protocols, printers and so on. Webster's dictionary infrastructure is defined as *a sub-structure or underlying foundation; esp., the basic installations and facilities on which the continuance and growth of a community, state, etc depends on roads, schools, power plants, transportation and communication systems, etc.* (Hanseth.Monteiro 2007)

Information infrastructure imparts a portion aspect with other sorts of majority of the data technologies, as well as need a one. Infrastructure:

- *Have supporting or enabling function*- It means that infrastructure have various functions not only the specific ones. M-health is designed to flow information regarding different aspects to the patient and health staffs. It consists of different information which make the work of an individual easier and easily accessible.

- *Shared by a larger community*- Means that infrastructure is used by all the members in a community not only a specific individual. M-health is also been shared by larger community in the remote areas as well as individuals in urban areas where information are shared between patient and health staffs.

- *Open*- It means that the information is open which indicate no limits for number of users, stakeholders, vendors involved, nodes in the network and other technological components, application areas or network operators. M-health is

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also an open infrastructure for all users. All the members and health staffs from different hospitals can easily access the information about the patients and further process can be carried out.

- *Are socio-technical networks*- Infrastructure encompass technological components, humans, organizations and institutions. There should be full involvement and support of people because this information infrastructure or m-health cannot work if the users are not using it in a proper manner. M-health is highly influenced by socio-technical networks as without them this infrastructure is of no use.

- *Connected and interrelated, constituting ecologies of networks*- Larger infrastructure are built based on existing smaller independent components called as interdependent. M-health gather information and send it to EPR database.

- *Extending and improving installed base*- Infrastructure as installed base is considered as replacing later one with the new version. It always has the revised version as they are not developed from the scratch. M-health includes the corresponding new version replacing the old one time and again (Hanseth.Monteiro 2007).

Hanseth and Lundberg discusses about work oriented infrastructure is such practice where properties are largely hidden from those users which are not the members of the system while the "classical infrastructure" can be called as "Universal service infrastructures" as they provide universal services to all citizens (Hanseth.O 1999). Similarly, Medic Mobile has been kept simple and can be used in any circumstances by all of the members.

Work oriented infrastructure systems are based on the standards which can be explained by the standardization bodies. The main aim of these systems is to improve the technology and new methods of working and providing services. Engineers used to design the software systems where the authorized personnel guide them to improve the technological systems and can also give them the ideas to make it user friendly in practice (Hanseth.O 1999). The IT system is kept as simple as possible so it can be well understood. To improve the technology, the IT specialists of Medic Mobile designed the technological system user friendly.

However, they say roughly that sharing and exchanging the medical information for work-oriented infrastructure seems to be problematic. Therefore, control over technologies is very important to design work-oriented infrastructures. And so is the usage of mobile health technologies as a work-oriented infrastructure. It should be controlled by the IT system which can be very reliable in the future for the users (Hanseth.O 1999). Medic Mobile IT specialists work on the users' participation and control the information been transferred through m-health applications.

Gunnar. E and Silsand. L gives opinion about Health sector as it has always shown a keen interest in implementing the ICT systems so that it helps in the decision-making activities. It is expected to serve the goals of the organization and to be safe and usable. Well-designed Clinical Decision Support (CDS) systems improves the healthcare quality, patients' outcomes as well as increase efficiency and reduce the healthcare costs (Silsand and Ellingsen 2016). The pregnant women in Baglung districts are kept as prioritize members and Medic Mobile have been serving those women through the Information Infrastructure systems as Mobile Health applications.

Ellingsen and Silsand also support that although there is importance of the system in supporting clinical treatment and care processes, the development and implementation of these systems has failed to achieve their goals when put it in practice. It shows many complexities like decision-making, intellectual challenges of creating knowledge, technical dimensions of delivering CDS and social aspects incorporating changes in clinical care. This however suggests that we should have a better understanding in socio-technical challenges. To handle the complex work, "local sensibility" with an "extended design" perspective has been put forward in the design and implementation of the new technology (Silsand and Ellingsen 2016).

The clinical decision support system helps in better understanding of the system implemented and helps in improving the healthcare system and needs essentially reducing healthcare costs. Medic Mobile helps by improving the healthcare facilities and thereby reducing the travel cost and providing more care and health care for pregnant women in Baglung district.

M. Berg and P. Toussaint explains, there is a huge change in the health care in relation to ICT. This move where care is more focused on the patients need, the emergency-based medicine supply and the development of the guidelines related to care of patients lead to the more development of the process-oriented ICT systems. The main aim of this systems is to gather the information flow between the patients and the health professionals and distribution of activities between them. This builds up a socio-technical understanding of the development of ICT along with the argument of reinterpretation and repositioning of models (Marc Berg 2003).

The relation built between the provider and users through Medic Mobile's m-health implementation has helped in building the good relationship and information flow between the patients and healthcare professionals.

According to G. Ellingsen and E. Monteiro, health information system is widely used in the healthcare system. This gives a motivation for the concepts like *continuity of care, shared care or integrated care.* The health care professionals should be readily available for the patients and there should be uniform flow of information between them (Gunnar Ellingsen 2008). The uniform flow of information between the pregnant women and CHWs has proved the concept of Ellingsen and Monteiro (2008) of continuity care, shared care.

Orlikowski talks about *the introduction of groupware into an organization to understand the changes in work practices and social interaction facilitated by the technology.* The premises where different individual work is more prone to the old technologies rather than implementing the new technologies. If they have poor understanding on the features of the new technologies, they stop using it properly in the daily work practice. Also poor circulation of the information results in the unavailability of information of the patients as well as no flow of information between the patient and health care professionals (Orlikowski 1992). The old version of Medic Mobile information infrastructure was not understandable and easy to use by the users. The features was difficult to learn and use (Mobile 2015).

R. Hirschheim states, *"workers should be actively involved in making decisions which affects them has been a belief for some time."* Participation in the development of a system is important but many argue as this may lead to political problems, difficult to design and

operate it as it takes long period of time to develop. Participatory design involves the development of a system by the users. The content of this design involves more of the technical matters whereas user involvement of this design involves the responsibility and control of the design process by the user itself. The positive reaction from the user help in the successful design implementation of the informational infrastructure (Hirschheim 1989).

The positive reaction from the users has led the engineers of Medic Mobile to develop the second version of *SafeSIM* which was effective, understandable and easy to use.

CHAPTER 3: SOCIO-ECONOMIC PICTURE OF NEPAL

3.1 Introduction

Despite some visible progress in infrastructure development and poverty reduction after 2006 political change, Nepal is still one of the least developing countries consisting of 460 rural municipalities and 276 municipalities, and 77 districts. The total population of Nepal is 28,087,871 and about 25 per cent of total population live under poverty line (2018). According to Center Bureau of Statistics Nepal (2011) agriculture is the mainstay of people in Nepal which provides livelihood for more than 60 per cent of total population and contributing about 35 per cent for GDP(2018). About 80 per cent population of Nepal live in rural areas where population under poverty line is above 30 per cent which is very high in compare to 10 per cent in cities (Nepal 2017).

Nepal is a mountainous country with diversity in culture. Geographically it has been divided into three different regions as mountains, hill and terai. About 50 per cent of the population of Nepal live in hill and mountainous regions. Out of 10 highest mountains in the world, eight mountains lie in Nepal including Mount Everest which has the height of 8,848 meters. Although Nepal is known as rich in socio-cultural diversity, beautiful nature and diverse geography, it has been suffering from modern infrastructure. About 24 percent of the total population live below the poverty line who earn less than 1.5 dollar in a day. Travelling to get a basic healthcare facilities has been an issue to the people living in hilly rural areas (Adhikari 2014).

Being a least developed country, Nepal has high population density with low GNPs, per capita income and literacy rate. Even with high birth-rate, Nepal is facing acute shortage of healthcare professionals, nurses, skilled birth attendants (SBAs). Different forms of communicable diseases, nutritional deficiency are very prone in all parts of Nepal particularly around high density of population living in rural areas (Subedi, Peterson et al. 2011).

Despite visible improvement of infrastructure in recent years, ensuring the basic needs such as quality healthcare, education, gender equality etc. have still been the challenging factors in Nepal. Low per-capita income, lack of modern healthcare facilities and basic needs have been defining feature of Nepal for a long time. According to Central Bureau of Statistics (CBS),

per-capita income of Nepali people in 2019 was US$ 1,133 whereas about 68 percent of the total population were literate. As an article published in The Rising Nepal, a national daily newspaper of Nepal, the patient-doctor ratio is 1721:1 and 1 nurse for every 500 people (Panta 2020).

Further, specialized hospitals, medical colleges and doctors have been confined in big cities such as in Kathmandu, Pokhara, Bharatpur, Biratnagar etc. It shows a clear disparity on providing health services because majority of the population as about 80 percent of the population in Nepal are living in rural areas (Roodenbeke and Organization 2011).

In Nepal, public institutions, private organizations and non-governmental organizations (NGOs) have been equally involved in healthcare system. At the central level, Ministry of Health and Population plays a critical and leading role on mainstreaming health sector. The public and private sector run 19 different medical colleges. Five medical colleges including one operated by Nepal Army are owned and operated by public sector, whereas 14 medical colleges are operated by private organizations (Department of Health Services 2020).

Government hospitals, primary healthcare centers, health posts, sub-health posts have been managed by different government agencies. The government had categorized these public health institutions, and handed over to Central (Federal), Provincial and Local Government after the promulgation of new Constitution. In Nepal, there are 102 government hospitals, 208 primary health centers, 1,559 health posts and 2,247 sub health-posts. Private organizations provide health services through hospitals, clinics, nursing homes, pharmacies and medical colleges whereas NGOs provide health facilities through community hospitals, clinics of NGO (Ranjit 2016). At a time of public health crisis like coronavirus pandemic, the Central government plays a key role, and assists to Provincial and Local Governments.

3.2 Importance of Telemedicine in Rural Health Services

Despite Government of Nepal (GoN) has been trying to improve the healthcare services focusing on the population in remote villages, people living in rural and geographically harsh terrains are still deprived from basic information related to healthcare services (Panta 2020). Pregnant women may not get immediate treatment and proper medical advices along with all the information which is required to take in that period. Even, regular check-ups may be a far

cry for women in rural villages. Maternal and child mortality mostly occur in the villages with less access of health services. Private hospitals have mostly located at big cities. Their prime motive is to make profit.

Further, people living in remote areas are compelled to travel hours sometimes even days to get basic healthcare services. Sometimes, they have to wait for a long time to see the doctor or healthcare provider. With multiple responsibilities and household chores like cooking, collecting water and firewood, rearing of children and working at farm, the women rarely get chance for regular visits at health facilities, even at times of health complications.

Moreover, patriarchy is common in rural Nepal. As a head of the family, male usually decide for everything. He has privilege over family matters sometime even decides what women should wear, eat, where to go and visiting hospitals. Mostly, underprivileged and dalit women face huge discrimination in receiving health services.

Therefore, poor infrastructure, lack of services, costs, shortage of healthcare centers at local level, women's status in family and their involvement in decision-making are some of the factors to increase the rate of maternal mortality (Baral, Lyons et al. 2010). The focus in improvement of maternal mortality rate (MMR) in Nepal came up with large amount of policy such as Safe Motherhood Policy (SMP) in 1998. During the 90s Nepal had even reduced its maternal mortality rate to 50% especially focusing on rural and remote areas (Engel, Glennie et al. 2013).

In Nepali context, telemedicine as a service, is the process of providing medical expertise and health services to remote, rural, and underserved communities in primary care, secondary care, and in emergency conditions with the help of telecommunications (Pradhan 2009). It is particularly helpful to deliver healthcare to remote and rural areas where there is an acute storage of medical specialists separated from most of the population in remote places (Pradhan 2009).

According to Parajuli and Doneys (2017), telemedicine reduced travel restrictions, treatment expenses, and apprehension regarding sexual and reproductive health consultation. Moreover, telemedicine decreased travel time, which helps women and girls access timely healthcare services and improve time management for household chores and other activities.

Telemedicine services in rural areas tend to reduce gender-based barriers for women and girls in accessing healthcare services (Parajuli and Doneys 2017).

A study conducted by group of researchers has shown that mobile phones and video conferencing have reduced travel restrictions, costs, and apprehension about sexual and reproductive health for women and girls (David j Meyers 2017). The findings in rural Nepal are likely to apply to many other parts of the world where computers and mobile phones are increasingly accessible. Telemedicine has reduced the frequency of long-distance travel to hospitals as women can receive care from the comfort and ease of their own communities (David j Meyers 2017).

Many girls and women in the study reported travel of less than one kilometer to receive healthcare via video conferencing. Mobile phone users reported no need to travel for healthcare services at all. That's especially important because women in rural Nepal often struggle to get the permission they need to travel.

Telemedicine have increased comfort in seeking consultation through telemedicine for sexual and reproductive health matters. Nearly all (97.8% of mobile phone-based users and 81.3% of video conference users) of the women and girls agreed that telemedicine has made it easier to ask about sexual and reproductive health issues. Overall, it has shown that telemedicine tends to reduce barriers to healthcare for women and girls in rural areas.

Mostly in the case of Nepal, telemedicine providers offer support for primary healthcare, specialist applications, and the treatment and management of all kinds of illnesses. These services are delivered by video conferencing and mobile phone devices mostly relying on video and voice for basic treatment. The focus is to access healthcare locally so that it can be diagnosed and treated (Morgan 2018).

The emerging craze of mobile phones has many benefits to the healthcare. Mobile phone is considered as the basic and reliable system of telemedicine. Implementing Medic Mobile has been a benefit for the people around rural districts of Nepal. In Nepal, it is a new concept and one of the informants has talked about its implementation and overview of the telemedicine applications.

3.3 Gender inequality: An Issue in Rural Nepal

Nepal is a secular federal democratic country where there more than 80 percent of the people follow Hinduism. In Hinduism, status of people is divided based on their caste and ethnicity which are known as Brahmin, Chhetriya, Baisya and Sudra. In traditional Hindu spiritual writings women are often symbolized as goddess and mother of all human creation. As Gurung (2016) writes, "A women is seen to create life, nature and strengthen it". However, low literacy of women, superstitious social values, and violence against women continue to prevail in Nepal. Although the traditional Hindu values believe women as a goddess, mother of all human creature, "women have been abused in every sphere of society, often treated as second-class citizens and commodities or objects" (Gurung 2016).

Gender equality is one of the much-spoken topics in Nepal. As social structure of Nepali society is based on patriarchal values, gender plays an important role in family as well as in society, male members of the society are privileged in the family as well as in the community decision making process. (Namasivayam, Osuorah et al. 2012). Limited education opportunity, ownership of the assets etc. have also become some of the major causes of gender inequalities in Nepal (Simkhada, Van Teijlingen et al. 2006).

In many cases, gender difference affects the health of the women and girls (Gurung 2016). The son preference has been a cause of the gender bias in Nepali society. The decision steps in a family member is mainly hold tight by the male members rather than female. Similarly, the female children are discriminated than the male children in the family. Health, investment is not in favor to the girls. Female children are considered as the one who will leave the house after marriage (Pokhrel, Snow et al. 2005).

In remote areas of Nepal, discrimination against female member of the family is still prevalent where parents usually hesitate to invest in health and education of the girls. The strong son-preference culture is one of the main reasons of the bias. Women are considered as a housemaker or housewife who cannot take the decision in household, children's health and other factors (Pokhrel, Snow et al. 2005). They are considered to work at home, help in the agriculture and do household chores. These are also one of the reasons for high maternal mortality and child mortality rate as they are not allowed to visit the nearby healthcare centers or take care of themselves (Pokhrel, Snow et al. 2005).

3.4 Marital status

According to UNICEF Nepal, 7 percent of Nepali girls are married before the age of 15 and 40 percent girls in Nepal are married before the age of 18 (UNICEF 2014). As rural population comprises more than 80 percent of total population, early marriage is one of the common problem in Nepal (Choe, Thapa et al. 2005). Patriarchal values, lower literacy rate, superstitious social customs are some of the defining feature of rural communities. Son's preference in the family, demand of workforce at agriculture, superstitious believe that girls should be married before the first menstruation etc. are some of the common reasons of early marriage (Aryal 2007).

Basically, in the southern part of Nepal – Terai region and in western and far western hilly regions girls are forced to marry before the age of 15. This gradually affect the early motherhood, child and maternal mortality (Choe, Thapa et al. 2005). Anemia and malnutrition are common among these pregnant women which increases the risk in pregnancy and complications during the delivery (Sharma, Verma et al. 2002).

In 2002, Nepal legalized the abortion at healthcare centers in certain conditions like rape victim, health complications, etc. whose main motive was to reduce abortion-related maternal deaths. Before 2002, illegal abortion caused nearly 15 percent of maternal deaths. These abortions were mainly carried out for sex determination of the child. Even after the introduction of legal provision, a large number of late abortions continues to prevail and risking the women's health. Young women aged 15-20 years are more prone to abortion due to unsafe sex, patriarchal society, early marriages, sex determination (Andersen, Khanal et al. 2015).

Marriages in Nepal forms a foundation of the family and it has been considered as a holy ritual for the community. Marriages vary in different castes and ethnic groups and it has its own value and tradition to conduct. However, the new constitution of Nepal, 2015 has prohibited child marriage. Under the Marriage Registration Act, the minimum legal age of marriage is 20 years for both boys and girls. With the parental consent they can marry at the age of 18. But marriage before the legal age is common in rural Nepal. Poverty, family practices, low literacy, lack of awareness, social values, superstition and self-initiated marriage known as love marriage, shame on pre-marital sex, lack of access to contraception

and access to information about family planning etc. are some of the common factors for early marriage (Aryal 2007).

Child marriage prevalence is still in practice in Nepali society. Girls of age group 15-20 years are still getting married in their adolescents' period basically in communities living in southern belt Terai and mid and far western hill. Family member believes that the door of heaven opens if they marry their daughter before menstruation (Thapa 1996). Though, average age of marriage is gradually increasing, child marriage has always been a talk of the society in Nepal over a period. Children as small as 6 years used to get married by their parents. Illiteracy, poverty etc. have always been a major factors for child marriage in Nepal (Aryal 2007).

3.5 Faith healing: The witchcraft in Nepal

Witchcraft is regarded as harmful and undesirable phenomenon for the society, and even the new Constitution of Nepal, 2015 prevents any form of witchcraft practices. It exists in every communities (Gurung 2016). As rural Nepal is suffering from patriarchal values where women are regarded as second class people and men have privileged over the women themselves as well as family and community affairs, the lack of adequate health care services, low literacy, economic underdevelopment different forms of violence is widespread all over the country.

The literary meaning of Witch is 'Boksi' in Nepali language. Witchcraft is a traditional form of healing of the people suffering from influences of bad power. Jhankris and Dhami are known as a witchdoctor in Nepalese society. People believe that they tend to cure the one who have been bewitched. These believes have led to many social violence in some parts of rural Nepal especially against women. These witchdoctors are generally men rather than women. They are also called as Guruba, Jhankri. Often witchdoctor have special status in the communities. When someone gets sick, he or she is taken to witchdoctor first. The witchdoctor obverses the sick and enchants special mantras and decides the causes behind the sickness, and the one who is to be blamed- the witches. The accused one is called to the witchdoctors. The witchdoctors perform some activities basically aiming to release the sick one from bad influence of witches. Sometime the witchdoctor beats the accused one with hot iron rod and bamboo sticks.

Witchcrafts are often performed with the sacrifice of hen or cock. Witchdoctors are often found in remote and in those communities with low literacy, lack of basic health services, far from big cities, superstitious population (Gurung 2016). Witchdoctors are well accepted by the society. They gain their knowledge by transforming themselves as a Jhankri, hereditarily and sometimes by choice. There are many cases in context of Nepal where witchdoctors are more popular than the healthcare professionals (Giri and Shankar 2006)

Witchcraft is a traditional form of social injustice and violence against elderly poor innocent women. It is not only violence against women rather it denies their human rights. Since last two decades with the penetration of educational opportunities and modern intra-structures the influence of witchcraft in large cities is gradually decreasing (Sharma 2009). The more and more people even in small cities and towns have started visiting health care center and hospitals. But it is still well practiced in the rural villages deprived from basic health facilities (Sharma 2009).

3.6 Public Health and Challenges of Telemedicine in Nepal

Inadequate infrastructure is one of the major challenges in Nepal. It has led behind in different aspects of development. Rural and underserved areas have suffered more in terms of development than the urban areas. Political instability, unsuitable landscapes, socio-demographic aspects, transportation has been a major cause for the development of the country especially in rural parts of Nepal. Large amount of deaths, accidents, spread of diseases mostly occur in the remote areas (Subedi, Peterson et al. 2011).

In Nepal, most of the diseases in underserved societies are related to communicable and infectious diseases. About 70% of all health problems and deaths in Nepal are attributed to infectious diseases (Commission 1998). People still die from simple diseases like diarrhea, malaria, encephalitis, dengue fever, hepatitis A and many more due to lack of knowledge or inaccessibility to medicinal services. Many children die from easily preventable and treatable diseases such as malnutrition, dysentery, acute respiratory infections, etc. (Rai, Hirai et al. 2002).

Skin problems are also common in rural areas, and lack of good hospital with doctors and other health professionals have been affecting peoples' health in remote. However different

stakeholders, government and private hospitals have made various efforts to address such problems. And there is somehow common opinion/consensus such diseases can be diagnosed with the help of Telemedicine services. If the implementation of telemedicine succeed, the government will be able to solve most of the health problems and prevent many deaths in rural Nepal (Subedi, Peterson et al. 2011).

Additionally, many doctors and medical specialists are neither fully convinced nor familiar with telemedicine, the very thought of diagnosing and treating a patient when physically absent, solely on the basis of data provided through the TM system, is not one that sits well with medical professionals (Ali Gattoni 2010). Furthermore, various studies have shown that the majority of patients from remote places feel uncertain about using technology-based remote health services, and many times reluctant to use telemedicine, decreasing the opportunity for providers to utilize the technology (Ali Gattoni 2010).

There is a uniformity of health problems and diseases among most of the rural communities where similar kinds of methodologies can be used to deliver health services. In the first phase, it is better to cover most of the mountainous districts and some hilly districts. Once telemedicine is utilized and people start seeing and accepting the benefits, the service can be expanded gradually to more districts. In fact, it is possible to extend telemedicine services to all the 77 districts to provide health services to people across the country (Subedi, Peterson et al. 2011).

One of the major problems that rural and remote communities of Nepal have been facing is lack of access to information technology. Since the IT revolution is limited to a smaller percentage of population, there is huge digital divide within the country. More than 80 percent of the computers and Internet connections are located in Kathmandu and other big cities only. This kind of disparity should be amended for the overall development of the country. For this, TM could also be a very good potential mode. Since telemedicine is possible only when ICT infrastructure is well developed, it will make ICT accessible to remote places and reduce the digital divide. Telemedicine may in fact have a more profound impact in developing countries than in developed countries (Edworthy 2001).

In particular, people who believe in a hands-on approach to healing are more comfortable with traditional medicine which comes from the laying of hands. These kinds of hesitancy on the side of both patient and physician toward the use of technology are remaining as a barrier to successfully adopt TM services (Subedi, Peterson et al. 2011).

CHAPTER- 4 METHODOLOGY

This chapter articulates the methodological framework for the study. It starts with presenting the background of the study area, methods applied for gaining access to the data and selection of the informants. It further tells us about the process of data collection and my role as a researcher.

4.1 Background of the Study Area

Baglung district was selected for the study. It lies in Gandaki province of Nepal. It is one of the districts with low human development index in Nepal. According to National Population Census (2011) the total population of Baglung is 268,613 where there the total population of male is 117997 and female is 50616 (Statistics 2012).

Baglung has 4 urban municipalities and 6 rural municipalities. It is situated in the hilly areas of Nepal where most of the population live either side of the river Gandaki. The plain land is mostly used for agriculture. It is surrounded by five different districts with diversity in culture, religion, ethnicity, areas, temperature and many more (Statistics 2012)

Baglung is rich in herbal medicinal plants. Most elevated temperature at the lowest height of Baglung ascends up to about 37.5 degrees Celsius in summer and the most minimal temperature at Dhorpatan falls up to about −15 degrees Celsius in winter. The height of Baglung district changes from about 650 meters at Kharbang to around 4,300 meters in Dhorpatan (Lillesø, Shrestha et al. 2005). Nepali is mother tongue of majority of the population and Hindu is major religion of the district.
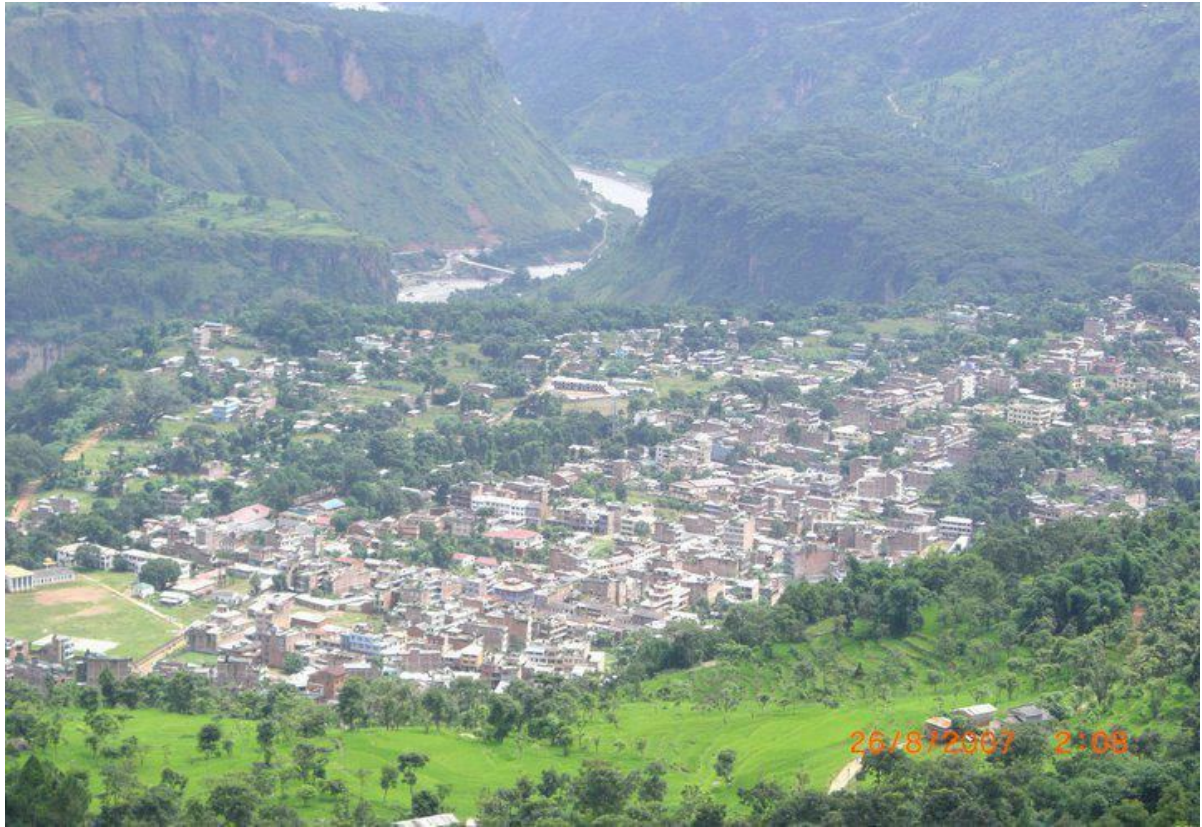
Fig 1: Baglung Bazaar/ Headquarter of the District

Fig 2: Map of Baglung District

4.2 Qualitative Research Method

The major objective of this study is to understand the impacts and challenges of m-health project (More specifically impact of Medic Mobile applications) on pregnant women and neonatal health in rural municipalities of Baglung district. Therefore, semi-structure interviews, focus group discussion, non-participant field observation and documents review were applied as main data collection tools.

Qualitative method of analysis is a process of understanding the social or human issues or perception in natural settings (Khan 2014). Qualitative method helps in *understanding the processes and experience (*Harper 2011*)*.

According to Jeff Sauro (2015), qualitative research approaches have been divided into five different types as ethnography, narrative, phenomenological, grounded and case study among which ethnography is a popular approach of qualitative research (Sauro). Ethnography as a research approach derives from the use of data-gathering methods together with the philosophical stance and the conceptual structure in which they are grounded (Forsythe 1999).

Implementing the Patient Care Information System (PCIS) in health care enhance the quality and efficiency of the health care organizations. Generally, in implementing PCISs different implementation methods are being used in which one of them is interpreting method of analysis. The other methods of evaluation fail as they cannot properly answer the questions. In addition, qualitative method of analysis is used to understand the phenomenon from the view point of participants which might include interviews, observations and document analysis (Stoop and Berg 2003).

The observation of the participants around the period is necessary for the interpretive analysis. Many sociologists are involved in observational study and are encouraged to use interview methods. Other qualitative methods generate problems of validity and reliability which might neglect the observation. The result of the interview depends on the socially situated activity where the responses play role between impression of interviewer and interviewee (Dingwall 1997).

Observational fieldwork helps us to identify the real world which we cannot observe through tape-recorded interview (Dingwall 1997). Observation is a valuable data which we perceive through our eyes and hear from our ears. It cannot be filtrated or biased through other or any documents (Yin 2015).

The qualitative research method is associated with social constructive theory which emphases the socially constructed nature of reality (Klein and Myers 1999). It involves about the recording analyzing and attempting to uncover the deeper meaning and significance of human behavior and experience including contradictory beliefs, behaviors and emotions (Klein and Myers 1999).

Qualitative research methods like interviews, observations and document analyses are best explained to understand a phenomenon from the points of view of the participants and in its particular social and institutional contexts (Stoop and Berg 2003). Qualitative research methods are best in identifying and selecting research topics for investigation. Qualitative methods are required to identify the costs and benefits, to anticipate focusing just on pre-determined indicators (Stoop and Berg 2003).

Qualitative research is designed to aid researchers in understanding persons and the social and cultural context in which they are situated which has been of particular importance in my case (Andersen and Jansen 2012). One of the difficulties in-built in completing examinations in 'this real world' lies in trying to say something sensible in regards to a complex, moderately inadequately controlled and for the most part 'unclear' circumstance (Robson 2002). The researcher is engaged in both data collection and their interpretation, and these activities have inevitably involved the researcher's subjective assessments. The study is built upon the observations, interviews and studies of the documents throughout the project period (Andersen and Jansen 2012).

As a qualitative research case studies, to a minimum, the collection of data should include details of research sites been chosen, number of people who are being interviewed, professional positions they occupy, other data sources been used, research period (Walsham 1995). In a qualitative interview, good questions should be open-ended (i.e. require more than a yes/no answer), neutral, sensitive and understandable. It is usually best to start with

questions that participants can answer easily and then proceed to more difficult or sensitive topics (Gill, Stewart et al. 2008).

Qualitative methods, such as interviews, are believed to provide a 'deeper' understanding of social phenomena than would be obtained from purely quantitative methods, such as questionnaires (Gill, Stewart et al. 2008). One of the approach is to tape-record all the research interviews as it provides description of what is said but it has disadvantage because it is time consuming to transcribe the recording or extracting data (Walsham 1995).

When designing an interview schedule, it is imperative to ask questions that are likely to yield as much information about the study phenomenon as possible and can address the aims and objectives of the research (Gill, Stewart et al. 2008). The phenomena are constructed and tested empirically, and mechanism of the work is described. A care in reporting is important because researcher must try to convince by presenting a clear point of view told with grace, wit and happiness (Walsham 1995).

4.3 Data Collection

I went to the districts where Medic Mobile program was implemented and ask those community health workers about the advantages and challenges, they have faced during this project. While talking to one of the informants I found out about the challenges faced during the implementation of the project. The regular lack of electricity, internet has been a main challenge to the project and to the individuals. I also found that mobile network was also a main issue during the project. Many times, the server goes down due to which there would not be any transfer of data. It has been 2 years since Nepal has been improving in electricity due to the new government. I think these projects would further be established to see and improve other health issues.

Health care professionals in Nepal also do not take any interest to work in the rural areas. Instead they are more interested in working in the urban areas such as Kathmandu, Pokhara.

Similarly, most of the patients also prefer to go to the hospitals instead of community health centers. This might be due to insufficient quality of services or they do not trust locally available health workers (Dhakal, Chapman et al. 2007). The telemedicine program can be

helpful to those kinds of situation where one can communicate to the doctors through mobile phones or video conferencing at nearby health care centers.

4.3.1 Study population and Participants Selection

As I have applied qualitative research method, I did not try to interview a lot of people. For the purpose of this study I interviewed sixteen individuals participated in Medic Mobile project in Baglung. The study mainly included Community Health Workers (CHWs), lab assistants and doctors in Baglung. Besides my informants in Baglung I got opportunity to speak with project supervisor, local political leaders, one specialist doctor in Om Hospital as well as a top-level government officer at Ministry of Health and Population of Nepal.

4.3.2 Focus group discussion

Focus group discussion is based on unstructured interviews offering various opinions on particular topic. Participants are allowed to bring different issues related to particular topic where there each participants can support and challenge each other's opinion and if needed can ask for further clarification (Bryman 2016). Focus group discussion is "*a form of interview with several people that involves more than on usually at least four interviewees emphasizes on fairly defined topics and allows participants perspective on research. The group is focused because members in the group presumably have some common experience or share some common views*"(Kafle 2015).

In order to get detail overview of the impact of Medic Mobile's project I had conducted two focus group discussions in Baglung. The participants were community health workers (CHWs) involved in the pilot project of Medic Mobile and local women who were benefitted from implementation of the project. The participants were selected based on their age, marital status, and their role. Different issues regarding, different issues of pregnant women and children, status of women, their role in household and community matters, mobile health, telemedicine applications, pilot project in Baglung, etc. were discussed during the focus group discussions. The advantage of focus group discussion is to gather large amount of information in a limited period of time (Longhurst 2003). These kind of discussions helps the interviewee to learn about the challenges faced with and without the telemedicine applications, gaining access to other information from the participants.

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4.3.3 Non-participants observation

According to Mulhall (2003), observation is one of the popular methods to understand socio-economically sensitive group. Mulhall (2003), further articulates 'using researcher's eyes and ears' is the essence of observation. It is an important method of primary data collection as "*what you see with your eyes and perceive with your own sense is not filtered by what other might have reported to you or the author of some documents might have seen*"(Yin 2011)

To understand the impacts of Medic Mobile program in Baglung, I had observed the interaction between the community health workers and local women. Similarly, formal and informal interaction with local people, available health professionals in the Zonal hospital as well as in local healthcare centers helped for further understanding about the challenges of local women in Baglung. I had opportunity to observe people visiting traditional healer. The regular interaction and opportunity to observe local activities helped me to understand, clarify and further interpretation of the findings of interviews.

4.3.4 Document review

Document analysis is one of the methods of qualitative research which reviews different kind of documents such as official document, multimedia, press release documents, web page, etc. to know about the particular factors (Bryman 2016). I studied about the information related to Medic Mobile and its implementation in Baglung district before and after conducting the research. I studied all kinds of documents published on this research either it is governmental or non-governmental publications, newspapers, published work articles, pictures, etc.

4.3.5 Interview

A total of 16 participants were involved in the project. 81.25 percent of participants were women. Around 12.5 percent of participants were men and 6.25 percent was girl below 18 years. The most participants minimum educational level was basic education. Few of them had tertiary level education. Women whom I had chance to interview were Community Health Workers (CHWs), housewives.

All the participants had one mobile phone and they primarily used it to communicate with closed family members. They told me that it has made their life easy to communicate with their family, friends who are away from home especially their sons and daughters. They also

responded that they had started using mobile phones just few years back. Some of them told me that they got to use mobile phones when the pilot project from Medic Mobile was implemented in their district.

The interview was conducted for the period of two months October- November. I had discussed with my supervisor about the questions to be asked for the project and with his guidance I planned to ask the participants about their demographic details, healthcare system in Nepal, use of mobile phones in relation to the healthcare, how and in what way are they using mobile phones. Some of the questions been discussed are as:

- How and where do you mostly use mobile phones?
- Do you need any kind of assistance while using mobile phone?
- Are there any problems you have faced after the usage of mobile phones?
- Besides of calling, do you know any other functions of mobile phones?
- Have you used internet in your mobile phones?

All the participants were interested and actively participates in the interview session. All 16 participants were interviewed individually. The interview lasted for 15-20 minutes for each person. Some of them even took 30 minutes having a brief discussion about mobile phones along with my background and description. Participants aged above 35 years were found more involved in the discussion session and were keen to ask about the advantages and disadvantages of the Medic Mobile in relation to mobile phones as a focus group discussion.

4.4 Purpose of involvement in Medic Mobile

Medic Mobile has been implementing *SafeSIM* project to reduce maternal mortality rates in rural districts of Nepal such as Baglung and Illam. One of the topics I discussed among the participants in Baglung was their purpose in supporting and involving themselves in this pilot project. The project has been really growing ever since 2015 and it has approached to expand its project to other 53 rural districts of Nepal. During the field study, I came to know that the child and maternal mortality used to be one of the major problems. However, due to regular visits of the CHWs child and maternal mortality rate is gradually decreasing in Baglung and local community further hopes for many more project like Medic Mobile.

Medic Mobile and its project in Nepal has shown a huge success in the rural district. The CHWs were selected in coordination between Medic Mobile and Government of Nepal. Firstly, the health workers were given mobile phones with a *SafeSIM* inside and they were taught to operate the mobile phones.

In the beginning of the project most of CHWs did not know how to use mobile phones. They were trained to use mobile phone such as opening the mobile phones, calling a person, opening the message box, going to the inbox and many more. They were taught to write the short texts to the community health supervisors which basically include the name, month, date of birth, last visits of the pregnant women. These all system were operated in coordination with the district health center in Baglung.

4.5 Ethical considerations and permissions

A research protocol was sent to my supervisor (Department of Telemedicine and e-health) at UiT, the Arctic University of Norway for approval. It was further sent to the ethical committee in Nepal for the approval of the project.

The participants were explained about the process of interviews and was taken consent from the participants as well. None of them were forced for the interview. They could take their step back from the interview if anything felt uncomfortable. The names of the participants were not displayed in order to maintain privacy. The study was done maintaining the ethics into consideration.

4.6 CASE INTERVIEWS

1. Pilot projects

Medic Mobile has implemented different pilot projects in two different districts – Illam and Baglung. But limited resources and apathetic behavior from stakeholder continuity of the project is always questionable. In the context of Baglung, implementation of Medic Mobile program has brought several positive changes on women and neonatal health, but due to lack of resources and enough budget local people are worried about the continuity of the project. One of the informants speaks about the projects that had been conducted before,

Telemedicine is a new concept to everyone. Once it has been started in Om hospital but due to financial problem it has also stopped for a while. Again, it has thought to bring into light the telemedicine services as Om telemedicine center with more advanced tools to conduct the services. But Medic Mobile stands out to be a successful pilot plant project in the country like Nepal. (Woman doctor 1)

The other informants share similar view regarding ongoing telemedicine projects in Nepal,

Similarly, there was also some projects conducted by the Population Services International (PSI) in some of the remote districts regarding birth control methods with the help of Female Community Health Volunteers (FCHV). It had also similar project where they help to give educational training to people in those districts with free distribution of birth control pills. The FCHV were fully involved on that project to reduce the rate of more births of neonatal. Actually, it was a good initiative to control the population of our country. (CHW 1)

The project was started on Baglung with seventy-seven CHWs and twenty-one supervisors in the year 2015. The CHWs were among the age group of 20 to 71 with an average of 40. Most of the women began communicating with the CHWs because of the age reliability. Pregnant women feel comfortable to talk to CHWs especially women of around the age 30-40. Communication was one of the challenges faced during the early stage of implementation.

As the project was started in the year 2015, it showed massive improvement in the maternal mortality rate with around 600 pregnancies and 200 births. This gave more opportunities to access this program surrounding village in Baglung. They even increased the CHWs to 500 from 71 to gain access to all the pregnant mothers in that district and surrounding villages. Due to this reason they were pretty much attracted by regular visits with the pregnant women and thorough consultation about the pregnancy before and after birth.

The CHWs were given training about the project for a week and further they started their work in the field visits with the obstetric women. The training helps the CHWs to text, call the CHWs supervisor and report them about the situation of the pregnant women. I found a chance to interview few people who was involved in this program as a project designer. The informant has shared similar view about the pilot project.

Community health workers (CHWs) who had been trained by Medic Mobile visits every pregnant woman and shares the ideas and information to them. CHWs had been given mobile phones where they are connected to certain number of pregnant women. They exchange the information and the condition of the pregnant women to the community health supervisors who further records the data onto the computers.

The teamwork and the project of the Medic Mobile has changed the life of those typical women who even could not go out of the house without the permission of their husbands or in laws. The connection between CHWs and pregnant mothers created by Medic Mobile has supported them mentally and physically. The regular visits even help them to know about the condition of the child and if there are any complications. CHWs has been deeply involved in the project to create awareness about the maternal mortality and neonatal mortality. They have been involved in maintaining the regular visits to the pregnant women in the district and surrounding villages.

2. M-Health in Nepal

M-health has always been an opportunity to improve the healthcare in developing countries like Nepal. Rural districts have been a challenging platform for the implementation of the telemedicine projects. One of the informants discussed about the mobile health projects in Nepal.

Medic Mobile have started this program with mobile health services in few districts of Nepal and I personally think it is a good initiative for development of the country. With every pro there comes cons. Implementing mobile phones services in rural districts is one but many people especially pregnant women they do not know how to use the mobile phones and most of them do not have. (Woman doctor 2)

Telemedicine and m-health has not been known to many people in rural districts of Nepal. Lack of different infrastructure and human resources has been a major challenge for the installed base like telemedicine. Informants shares the mobile health projects view in context to Nepal as,

I think taking an initiative to change the context of remote areas through telemedicine is itself a big goal. Telemedicine should also be known to all the people around the country. Only few people in health sector knows about telemedicine. But the main problem of our country is the lack of infrastructures and human resource. We are economically poor but governmentally also we are poor. **(**Woman doctor 3)

One of the informants discusses about the problem related to the paper-based information and the difficulty in maintaining it. Similar view has been shared by one of the informants regarding the telemedicine implementation as,

Telemedicine itself is advanced technology which our country is trying to implement in the remote districts. Implementing this technology not as a pilot but a big project would be a great benefit to our country. We as a lab technician also could use these technologies in consultation and further use. Telemedicine implementation will make a change in the future of our country. (Lab assistant)

3. Mobile phones and electronic devices

Recently in these 5 or 6 years, people has begun to access mobile phones. access to mobile phones was very difficult a few years back especially to women. Women were always deprived of access to mobile phones and further health information. One of the informants shares her view on this topic.

Since it is a rural district of Nepal. Access to mobile phones and other electronic devices was highly impossible for many of those women. (Adult Woman 1)

Internet facilities, electricity is a major challenge for the implementation of the pilot projects of telemedicine. Along with the challenges government also must take an initial step towards women empowerment. This can help in reducing most of the illiteracy problem among women in rural districts. Other informants also share views regarding mobile phones.

Telemedicine could change the status of the remote areas of our country. But to expose this initiative throughout the country is a big challenge. The Government should be financially able to take this big step. There are some other challenges to this project to come true. Some

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of them includes mobile phones for each individual, electricity, mobile network and a lot more. Government should make this in practice in health sectors not only in the plans and policies. (Woman doctor 3)

4. Witch-doctors

The practice of people visiting witch doctors to heal the issues related to health is common in rural Nepal. Some of the informants shares their views regarding witchdoctors and their prominent situation in the context of rural Nepal. Some views about witchdoctors,

Recently there was such kind of case where a girl fell sick. She probably had some skin infection due to which she was itching her body really hard. Instead of taking her to the health centers or hospital, she was taken to Witchdoctors. They believe that these Witchdoctors can cure all types of diseases. I think the lack of good health care centers accompanied by socially practiced traditional beliefs are restricting people in remote to seek modern health care services. (Adult Woman 1)

The regular visits of CHWs and their awareness program has really changed social values. The number of people visiting witch doctors have been decreasing gradually. One of the informants share her opinion,

Ever since Medic Mobile has been implemented in our district, the sight of watching the perspective of health care has changed. We always used to visit Witchdoctors to solve any problem related to diseases. CHWs has taught us about self-care, why should we visit doctors instead of Witchdoctors and many more. (Adult Woman 2)

Healthcare centers are not visited by the locals during the period of pregnancy. They either prefer to visit traditional doctors or they are bound to stay home. One of the informants further says that:

During the pregnancy, my husband took me to Witchdoctor rather than healthcare centers. After the implementation of Medic Mobile project, CHWs come to visit at home. It gave me great support when having the second child. (Adult Woman 3)

5. Gender-inequalities

Gender inequality is one of the drawbacks of the rural communities in Nepal. While entire world is developing rapidly, rural women are still suffering from discriminatory social values. According to an informant,

It is still a male dominating society and women are not allowed to go wherever they want. Males do not allow women to go to the hospital or nearby healthcare centers. Rather they would take them to Witchdoctors which is still very popular in rural villages in Nepal. (Adult Woman 1)

The male preference of the communities has always been a major challenge for the women in rural Nepal. Women are not allowed to talk, visit the health personnel without the permissions from the male person at their home. One of the informants' express view as:

I cannot go outside home without permissions from my mother-in-law. I work here at home and go to land to work in the daytime. I am not allowed most of the time to visit the healthcare centers. My husband does not allow the male volunteers to visit me. He is little possessive you can say towards women in the house. I do not know when I can make my own decisions. (Adult Woman 3)

6. Maternal Mortality Rate

In a focus group discussion, the participants were discussing about the problem of child and maternal mortality. The participants articulated that the child and maternal mortality used to be one of the major problems. However, due to regular visits of the CHWs child and maternal mortality rate is gradually decreasing in Baglung and local community further hopes for many more project like Medic Mobile. One of the informants share her ideas about the project.

We did not expect that the maternal mortality rates would drastically drop down within few years of its implementation of Medic Mobile. But it is also true we have lots of rural areas around countries where maternal mortality rates are still high and to reduce its rate, we need

more projects and telemedicine facilities around those areas which I think is highly impossible right now at these situations. (Woman doctor 1)

As asked to one of the informants about the mortality of obstetric and neonatal, the informant described the work experience and the reduced rate of obstetric and neonatal after the implementation of the pilot project in the year 2015. The informant had been working in the nearby health centers for a long time and explained about the situation of the district health center at Baglung.

First of all, maternal mortality rate in our village was very high few years back but now it has decreased to nearly half of the mortality rate which was before. Neonatal and maternal mortality rates have always been a high issue in the village. (Adult woman 4)

The maternal mortality was very high a few years back. The telemedicine projects by the NGOs and INGOs has helped a lot in reducing the rates in these recent years. As asked more about the maternal health and how it can relate it to the informant, the informant says,

I have been working in this field for more than 18 years now. I have seen so many cases where the patient are not able to reach even the primary health care centers. Whoever regularly visits PHC also do not get feasible treatment resulting in a rush to hospitals which again is impossible to reach from rural districts. (CHW 2)

The unhygienic living environment, childbirth and different infections due to carelessness has led to more deaths of pregnant women and child in the developing countries like Nepal. One of the informants talks about the unhygienic condition of the childbirth and shares view,

Many women suffer from early childbirth, infections, unhygienic living standards. There are women who give birth to child at home in a totally unhygienic environment where in this 21ˢᵗ century is totally unacceptable. (CHW 3)

Maternal and neonatal mortality rates have been gradually decreasing from the past few years. One of the informants shares her experience about the maternal mortality rates.

I have been serving to the health sector for 15 years. Having patients with different problems has been always common for me now but with more maternal mortality rate in our country in

last few years is disastrous. Especially in remote districts these problems are common if you travel to whole country. (Woman doctor 3)

7. Experience

One of the professional shared views about telemedicine and expressed views about the project in Nepal. The informant even mentioned about the telemedicine services in other European countries with the advanced facilities. The informant has similar thoughts about the telemedicine implementation in developing country like Nepal and shared views as:

Implementation of telemedicine is a huge change in our country. Indeed, there has been different program which have shown interest in our country but to change drastically to these facilities is highly impossible. (Woman doctor 1)

Telemedicine are very prone and in use in developed countries as compared to low-and middle-income countries. The information is gathered and learnt from mobile applications. The informant shares experience about the other developed countries as,

I have also travelled to European countries and have experienced these telemedicine services. They have highly equipped facilities where experienced doctors are involved with the procedure. To come over at that point in our country is beyond the thought. But I am not saying it is impossible in the near future, it takes time. (Woman doctor 2)

8. View of project supervisor

As asked about the project and view regarding Medic Mobile and telemedicine applications, one of the informants (project supervisor) shared her view regarding the project as:

I have worked in similar projects like Medic Mobile before. I personally think that Medic mobile has a very good initiative to change the map of country. Medic mobile together with Government of Nepal (GoN) and Ministry of Health (MoH) started its pilot project firstly in rural district Baglung. And further it has prolonged its project to other rural districts as well. (Project Supervisor)

Similarly, the informant also shares the difficulty faced at the beginning of the project. Since most of the CHWs were unable to use the mobile phones and further carrying out the fieldworks, they were involved in training the CHWs before the field visit.

This project in future with good investment from government would take our country to next level of development. We have found some difficulty initially since some Community Health worker (CHWs) were not able to use mobile phones. With proper training for some weeks they were able to text, call health workers at primary health care centers. (Project Supervisor)

The informant talks about the hesitation and anxiety of the women to visit the health care centers and restrictions to visit by their family members especially men. The unhygienic condition of the women during pregnancy has caused most of the maternal deaths in Baglung district.

Pregnant women on rural districts do not go to health care centers, even if they go for regular check-ups they do not want to be recorded. Many hesitate to talk with male doctors, while some prefer to give birth at home which eventually lead to death of mother and newborn. This unhygienic delivery increases the rate of maternal mortality rates. (Project Supervisor)

These maternal mortality rate reductions have been the goal of Medic Mobile, says the informant. Urban areas are little bit more conscious about the maternal health and tries to maintain the regular visits of the mother to the hospitals and health centers as compared to the rural areas.

If you compare these pregnant women with urban areas rates of visiting hospitals and health care centers, there is vast difference between these numbers. Medic Mobile has mainly focused on these aspects. (Project Supervisor)

9. Healthcare

The trend of giving birth to a child at home was very common few years back. Women used to feel uncomfortable to go to hospitals or nearby healthcare centers to talk about pregnancy

and other complications they face during those months. One of the informants talks about healthcare system as:

One woman give birth to more than two children in a house which creates problem for the mother as well as suffer economically. Many cases in this hospital are due to birth of many children by one mother. Can you believe few years back one woman used to give birth to twelve children or more than that and not in the hospital? You can imagine how unhealthy and unhygienic birth used to be in our country back then. (CHW 1)

Before, women used to give birth to eight or nine children. Most of the them even died due to unproper health condition and hygiene. One of the informants who was around 80 year shares her experience and view about the pilot project been undergoing in Baglung.

It has not only helped the pregnant mothers but also to those who are expecting and to those whose child has already born. I have never got out of the village. All my life I have stayed here. My children were born here in this house. Before we women used to give birth in home but nowadays, they go to hospitals. I think one should give birth to the child in hospital where all professionals would take care of the mother and child. (Older woman 1)

The informant shares her story about the pregnancy and childbirth. The problem faced by the mothers before has been slowly reducing and improving after the implementation of Medic Mobile. Informant shares experience as,

My son died due to lack of proper health services and proper care after 4 months of the birth. I think it was also due to my age. Before we used to get married around 10-12 years. And soon after our first menstruation we used to get pregnant. This project is doing really well and good for those pregnant women. (Older woman 1)

10. Medic Mobile

Implementation of Medic Mobile has been an initial stage of implementing telemedicine in developing countries like Nepal. It is considered as a step towards development of health sectors especially in remote districts of Nepal where people are deprived of getting basic

healthcare facilities. One of the informants talks about the benefit the project has brought in Baglung district as,

Medic Mobile has implemented its pilot project in Baglung district as an initiative to the telemedicine in our country. Initiative of Medic mobile has brought light to the health system in our country. This pilot project could be the future of our country where every pregnant woman would be safe and hygienic. (CHW 1)

Medic Mobile has successfully implemented the mobile health application in Baglung district. It has also expanded their project in another district as well. Such experience is shared by one of the informants as:

I think Medic Mobile has done good work with respect to all the pregnant women and neonatal care. We sometimes on field visits could not save the neonatal as they used to die inside mother's womb due to unsuccessful treatment. If by any chance that would be possible in those areas, then maybe some initiatives could be done. (CHW 2)

One of the participants told me about the telemedicine and how it has been evolving from the basic telemedicine services in a hospital setting to pilot projects throughout the district. The informant had the understanding of telemedicine and its usefulness and how it can be helpful in the near future.

I think telemedicine is slowly approaching to the developing countries like Nepal. And I personally think it has been a big step towards near future. As to mention about Illam and Baglung districts, Medic Mobile have approached for the good rural districts in Nepal. To work in the project like Medic Mobile has been a totally new experience for me as I have been serving as a health assistance to our country. (CHW 3)

11. Healthcare assistants- Patient Interaction as one of the challenges

Women preference to interact with the female healthcare professionals are very common in Nepal. Not only the rural areas but in the urban areas like Kathmandu also. Women and girls prefer to visit female doctors more as compared to the male doctors. They feel more secure

and can talk and discuss about all kind of health issues with them. One of the informants talk about some challenge faced during the project.

There were some challenges when this project was started. Women and girls did not feel comfortable coming out of the houses and talking with the health assistants. Giving them mobile telephone and asking them to report about the health issues and challenges was very difficult for us. Slowly women started showing interest and started using mobile phones for gaining and receiving all kinds of health information. (CHW 3)

Women in Nepal, particularly from villages feel awkward to share their health issues with male doctors. Many people still do not allow women to visit the health care center. The group of women who visit the health care centers does not want to meet the male doctors. This have been the main challenge across rural areas of Nepal.

One of the informants shares her views and experience about the view of the society and the result of the visit to the nearby healthcare centers.

I feel shy to go to the health care center. When I walk out of the house, everybody on the way ask me where I am about to go. If told that I am about to visit doctor at the health care center, everybody stares at me making uncomfortable situation. They think that I was having a serious problem and should not go near me. It is difficult to go to the health centers even for minor problems like fever, menstruation pain, etc. (Young girl 1)

Women feel hesitated talking to male doctors. They are not able to share their problems as freely to women doctors than male doctors. One of the informants share her view on the awkwardness between the male and female healthcare professionals.

Discussing all women related problems to the male doctors makes me not wanting to go to the health care centers. I feel awkward to visit male doctors and discussing problems related to women. I think I would be more comfortable and open with the female doctors than male doctors. (Adult woman 5)

12. Distance

As of one of the informants shares her views, walking to nearby health care center is difficult due to the steep hill and lack of good roads. In some of the serious cases travelling to nearby hospitals takes hours. One has to travel around 3-4 hours to reach a nearby hospital.

The informant shares her views as;

Excess to hospital is very difficult for us. To go to nearby hospital takes 2-3 hours by the fastest route possible. Sometimes it is also not possible to reach within 3 hours. There are chances not to find doctors in the nearby health care centers. Since it is a rural district, qualified doctors and nurses does not show any interest to come and work in the villages. (Adult woman 3)

13. Community Health Workers (CHWs)

CHWs have been a major part while implementing the project. The regular visits of CHWs and their recording of the pregnant women on daily basis have marked the safe delivery of the child. One of the informants shares the experience while working as a community health workers (CHWs) with Medic Mobile.

The mobile phones provided by Medic Mobile has given us access to healthcare facilities in an ease term especially to the pregnant mothers. In any emergency situation which arises in our community, the CHWs receives text messages due to which an emergency team gains access to the situation. I really appreciate the teamwork and the project they have been doing in the district. (Adult woman 2)

One of the informants who was also CHWs mentioned about the situation of the village and how the society has affected the basic communication of the women to other person or health officers. The informants view about those matters are serious issues in today's Nepal and few challenges faced during the regular visits to the women in Baglung. The informant says,

I have been working as a Community Health Worker (CHW) for this project. I had never worked on any sort of project before. They asked me to help with the project along with other members. They first gave me training as how to use mobile phones and to use basic phones

calls and messages during the project. My job is to go in each and every home possible and teach other ladies to use the access of mobile phones. (CHW 3)

The projects firstly helped all the CHWs to record the data and use of mobile phones. The training was given to all the volunteers. When the informant was asked about the mobile health and how did they learn, the informant replied as,

I learned from the senior persons about all the things and pass them to the people out there. It was a training period for us for about 1-2 weeks. We used to gather together, all the CHWs staffs who were not able to use mobile phones and teach them. I think it was fruitful to us learning all those things. And I think it was more educational and important to those women who considerably need them. (CHW 4)

14. Paper-based information

I got a chance to speak to one of the lab technicians who shares views regarding the paper-based information of the patient and its difficulty. Electronic data of the patient is much more reliable than the paper-based information. Nepal is behind the electronic record information as well as electronic prescription method.

One of the informants had some views regarding paper-based information and telemedicine,

But we itself are having problems with the paper-based information. The patient records are written in paper and dumped somewhere in the store which leads to damaged health records of patients. (Lab assistant)

The usage of computer-based patient information was started a while ago and slowly has been taking a change to a new level. The electronically recording the patient information will be helpful in successful implementation of the project. The informant shares few information as,

They have initiated to write some basic demographic information on computers but having whole patient records on computer has not been implemented yet. I think electronic patient records is important to have at least to hospitals where more than 1000 patients come to visit with different cases. (Lab assistant)

The informant also shares about the low amount of health care professionals and the time taken to share a report about the patient as,

Labs are really on pressure each day and to have right results sometimes we have to wait for few days until some experts give their views. (Lab assistant)

The interest of dragging themselves in contact to the CHWs was the first step of success of implementing this project in Nepal. Although there are lot of cases where men do not allow women to talk to others especially the one who are involved with any kind of the projects. In the male dominant society, it becomes difficult for women to go out and talk about their health conditions and gain awareness regarding any diseases. The reason behind antenatal death is lack of awareness and care in developing country like Nepal.

One of the informants share her experience regarding the issue.

Firstly, I was not involved with this project. Neighbors of mine started getting health information and a regular visit of community health workers drive me a little interest in this project. I was also four months pregnant and to visit health care centers was difficult for me since the roads are not smooth. (Adult woman 3)

The informant was asked about the CHWs visits and the advantage the informant has got after the implementation of the Medic mobile and shares the views as,

Community health workers (CHWs) taught me how to use the mobile phones and in an emergency situation what should I do. My husband was against this at first but slowly when CHWs kept on visiting for a certain period of time, he also started getting interested. I think this project has changed life of pregnant women during pregnancy and after pregnancy. (Adult woman 4)

CHAPTER 5: THE CASE STUDY

5.1 Introduction

Nepal is a developing country and it has been continually involved in reducing the maternal and child mortality rates. There have been various factors to increase the mortality rates in Nepal including poor socio-economic condition, illiteracy, access of services, etc.

Though Nepal has witnessed a significant improvement in maternal and under-5 child mortality rates, the maternal mortality ratio is still 239 deaths per 100,000 live births, and pregnancy-related mortality ratio is 259 for every 100,000 live births while lifetime risk of maternal death is 1 woman in 167 can be expected to have a maternal death while age 15 to 49 (Ministry of Health 2017).

Likewise, the neonatal mortality rate is 21 deaths per 1,000 live births, while the under-5 mortality rate is 39 deaths per 1,000 live births. This means that 54% of all under-5 deaths occur in the first month of life. Between 1996 and 2016, neonatal mortality fell from 50 to 21 deaths per 1,000 live births, infant mortality declined from 78 to 32 deaths per 1,000 live births, and under-5 mortality fell from 118 to 39 deaths per 1,000 live births. Childhood mortality rates are higher, by 10 deaths per 1,000 live births, in rural areas than in urban areas. Neonatal, infant, and under-5 mortality rates are 26, 38, and 44 deaths per 1,000 live births, respectively, in rural areas, as compared with 16, 28, and 34 deaths per 1,000 live births in urban areas (Ministry of Health 2017).

According to the survey, neonatal mortality rates are 36 deaths per 1,000 live births among children whose mothers have no education and 12 deaths per 1,000 live births among children whose mothers have secondary level education or higher. The educated pregnant women were seeking services either from Skilled Birth Attendants (SBA) or Hospitals (Statistics 2015). Most of the women in the rural areas could not complete their regular postnatal and antenatal visits (Authority and Kathmandu 2019).

5.2 Medic Mobile

To address the shortcoming of health care facilities available in rural Nepal particularly to pregnant women, a web-based Medic Mobile application was launched in 2013 as a mobile

phone technology for healthcare benefits. This simple mobile application was very helpful for the Community Health Workers (CHWs) to understand and use it effectively without much technical skills and higher education. Most of the CHWs had basic education level and basic technicality. As a pilot program, the Medic Mobile services was carried out in Baglung district. The CHWs used to visit homes and register the obstetric health information in the mobile health application. This helped in managing the increasing rate of pregnant women in the district where women were illiterate or basic level of education. The Supervisors collect all the data from the CHWs, and they used to guide the CHWs in all different kind of work. They used to schedule the CHWs and teach them in doing the follow-ups who have the high-risk pregnancies (Mobile 2015).

The main objectives of Medic Mobile:

- Remotely register pregnancies
- Track on-time and missed antenatal care visits
- Guide health workers through visit workflows
- Screen for high-risk pregnancies and danger signs
- Refer women to facilities for safe births

Medic Mobile has been continually involved in improving the mobile health application keeping the users in the first place. Medic Mobile group tried to prove that the digital world helps in reducing the risk of pregnancy in rural Nepal. The different activities that has been part of Medic Mobile includes interviews, home visits, focused group discussions, activities between CHWs and CHWs supervisors, tests of instruction and computerized abilities of the CHWs and many more. The project sets a good example in designing the mobile health applications along with users satisfaction (Mobile 2015).

The Government of Nepal had started national Safe Motherhood Program in order to reduce maternal and neonatal mortality rate improving the healthcare in the year 1997 (Authority and Kathmandu 2019). In the past fifteen years, the maternal mortality rates have declined, but still there is huge disparities between cities and rural areas. Due to limitation of opportunities of education, infrastructural constrains, loopholes in service delivery etc. are some of the factor of higher maternal mortality rate in rural areas (Mobile 2015).

Nepal has a goal to perform deliveries by skilled birth attendance (SBA) on maternal and neonatal health (MNH) or healthcare centers to 70 percent by the year 2020. There have some difficulties in achieving these goals such as lack of access to hospitals and health care centers, low number of antenatal and neonatal care (ANC) consultants (Authority and Kathmandu 2019). To address these problems, Medic Mobile was implemented to overcome the disparities and difficulties in the year 2013.

Medic Mobile along with Nepal's Ministry of Health (MoH) are helping the community health workers (CHWs) in conducting regular home visits of the pregnant women using mobile phones. The CHWs receive remainders regarding the follow up visits of the expected mothers through mobile phones. The health workers follow up pregnant women regarding antenatal care (ANC), antenatal visits, consultations and postnatal care (PNC) and postnatal visits (Mobile 2015).

The main objective of the Medic Mobile was to increase the rates of ANC visits and healthcare centers deliveries among the pregnant mothers. Medic Mobile has targeted around 60,000 community health workers to work in the project in Nepal (Mobile 2015). Medic Mobile has undergone rounds of field visits two times, making the stakeholders to analyze the project before being implemented as a pilot project. More than 40 percent of CHWs involved in the project have no basic education. Medic Mobile group further included a feedback from the users in order to clarify the mobile health application system and make appropriate changes (Mobile 2015).

The primary design led to the implementation of Medic Mobile with around seventy-seven community health workers and twenty-one supervisors in Baglung. The motivation behind the pilot was to test the practicality of the implemented area among the CHWs and to receive feedback from the users for further improving its design. The CHWs of the pilot project showed the educational and ethical observation around the district (Mobile 2015).

The pilot usage implementation brought about basic moves in the program destinations and procedures concerning the framework's center advances. The first design of Medic Mobile included the feature of reporting of high-risk pregnancies within the community health centers. After the implementation of the pilot project, it was found that community health

workers preferred to make a phone call in an emergency situation and ask for assistance. They preferred to text for non-emergencies as well as a back-up plan in low network area (Sharma, Harsha et al. 2015).

Fig 3: Medic Mobile projects on utilization of mobile phones for obstetrics patients

Medic Mobile utilized this understanding to update the work process to permit CHWs to present the reports immediately after making an underlying telephone call. This highlights the significance of persistent input for a continued client configuration process. Feedback from focus group discussion revealed that there was low inspiration among CHWs (Sharma, Harsha et al. 2015). Keeping in mind Medic Mobile implemented short text message confirmation after each report they have collected and submitted in order to increase the visibility of the community health workers in the health care centers.

The first pilot project implementation in Baglung district of Nepal disclosed that the target group needs to be expanded as well as it was also for sure to scale up their role and community supervisors needed more information to support and encourage the community health workers. This helped in the modifications of the role and information of community supervisors and community health workers (Mobile 2015).

The initial design included simple mobile phones and SIM-card applications. As we compared the simple mobile phones with the smart phones, simple mobile phones were more cost-effective and familiar to the community health workers. Since, CHWs were using SMS services to communicate these simple mobile phones was handier in the areas with low connectivity of internet and services. Later, Medic Mobile team developed a SIM-card application for further data collection and storage of the report and research. This application supports the menu-driven forms to immediately access the response and also ensures the accuracy in the data entry. Further, Medic Mobile investigated the SMS tools which did not involve menu-driven forms and radically simplified the data collection procedure (Mobile 2015).

Eventually after an investigation on the pilot project, it was found that community health supervisors who used the system to monitor and supervise the community health workers needs to access the information from the mobile phones instead of any web-based text. Thereby, Medic Mobile upgraded the SMS schedule with an alert message when new pregnancy was registered in order to verify all the expected mothers were registered. This improvement simultaneously results in an inclusive report of the expected mothers, delivery date and information, community health workers allocated as well as antenatal care consultations (Mobile 2015).

Further supervisor could then incorporate the Medic Mobile Unique ID with the moms' authentic Maternal and Neonatal health (MNH) register at the nearby healthcare centers, and effectively represent any disparities between the two frameworks. The Medic Mobile advanced arrangement included organized SMS presented by CHWs to a web-based application for listing out pregnant women. A mechanized update framework and announcing dashboard underpins the responsibility between pregnant women, CHWs and their administrators. The framework incorporates digitized data from the authority MNH register in improving the institutional and SBA conveyances just as ANC inclusion for pregnant women (Mobile 2015).

The pregnant mothers are identified, and the information is registered through SMS and create a patient ID calculating the expected date of delivery and schedule the automated remainder messages in the mobile phones of the CHWs regarding ANC and delivery date.

These alerts are sent to CHWs during whole period of pregnancy of expected mothers. Also, the CHWs give counselling and education about the ANC and encourage them to visit the nearest health care centers during their pregnancy. This process is recorded and sent as an SMS to the Medic Mobile application through CHWs and if the SMS are not sent within two weeks of the antenatal visits, the community supervisors are alerted about the issue (Mobile 2015).

Mothers with a complicated case are especially taken care of by the CHWs. During the pregnancy if the CHWs found any complication, they sent out an SMS alert to the Medic Mobile application or directly calling them whereby the Medic Mobile sends SMS to all the healthcare centers. After the birth of the child, CHWs confirms the birth of the child as 1) at home with or without trained health worker, 2) at health care services providing obstetric care services (Mobile 2015).
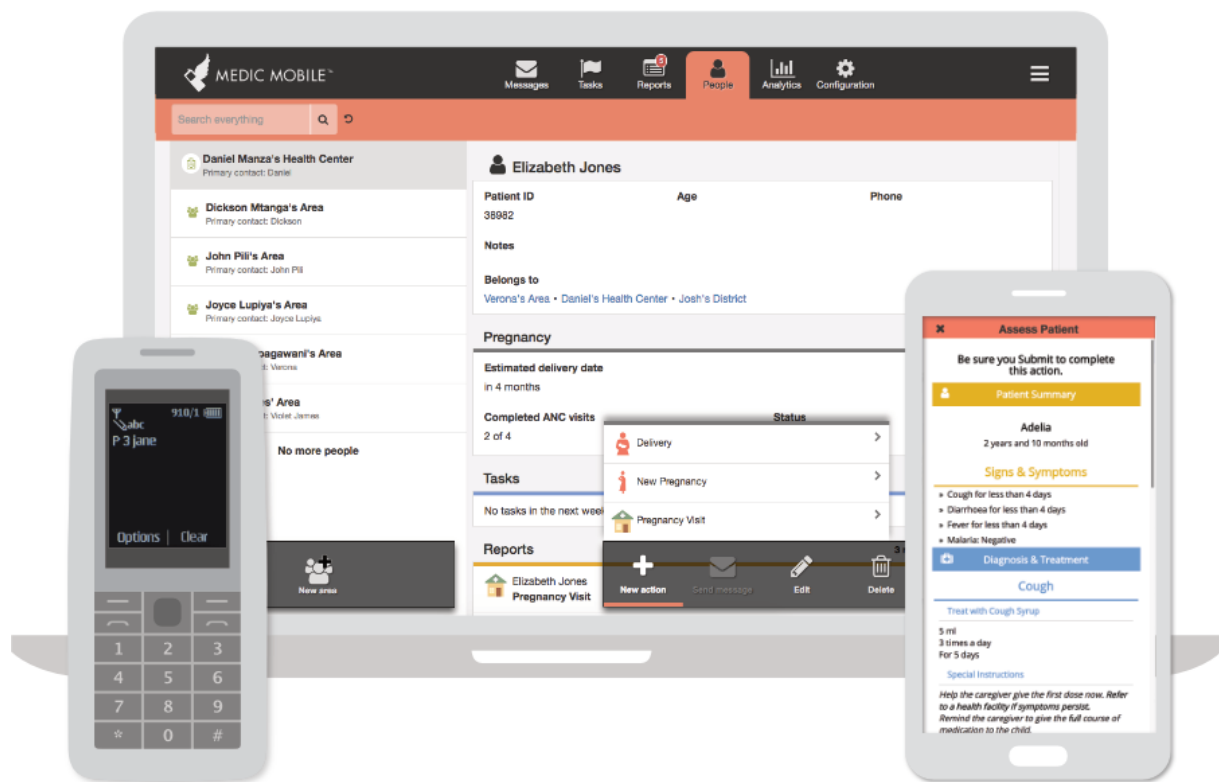

Fig 4: The overview of Medic Mobile application and its use

The SMS or text sent by the CHWs are incorporated by the Medic Mobile web application which further can also be translated to Nepali language and are listed by application. This overall information is observed and supervised by the public health administrators. The CHWs are trained with the help of questionnaire and pre-trial of computerized skills in order to be sure that the CHWs have least aptitudes to function the Medic Mobile application individually in different communities. After the training period, CHWs get a user manual to learn about sending and receiving SMS and other functions of mobile phones.

The Medic Mobile dashboard keep an updated information on CHW activity along with the outcome from the project. Similarly, the community supervisors keep a follow-up with the CHWs through text message or phone calls or scheduled visits. The feedbacks from the CHWs help in improving the efficiency of the application which Medic Mobile takes as an important review to be better in the future.

Medic Mobile has a secure web application according to the guidelines of the country with protocols. Data security and confidentiality are signed by the CHWs during the planning of the project and hence further. During the pilot project in the year 2015, it has showed that the training among the CHWs has increased literacy for some of the low-literacy CHWs in reading, writing and fluency in communication as well. This training has indirectly supported the people with low skills and having the group project with both high-literacy and low-literacy CHWs.

In the year 2015, the pilot project of Medic Mobile implementation results in seventy-seven CHWs from the four villages around Baglung district used SafeSIM application registering 604 pregnant women and 215 births which is almost the two third (64%) of the birthing centers in Baglung.

The qualitative assessment of the program stated that Medic Mobile's application have increased the regularity of contacts and visits of the pregnant mothers and newborns and new mothers as well. Notwithstanding accomplishing wide appropriation of the Medic Mobile correspondence framework, the pilot demonstrated that a low-transfer speed mobile-health framework can dependably sort out furthermore, computerized SMS messages for improved observance to the endorsed ANC plan. Furthermore, 6,920 pregnant women have been

registered, 13,567 confirmed ANC visits and 4,989 deliveries have been confirmed just in Baglung district (Mobile 2015).

Medic Mobile has been implemented across twenty-three different countries with 14,000 health workers. In Nepal, the Medic Mobile has expanded its program initially to three districts and ten more districts outside Baglung with 7000 CHWs along with 200 health care centers. Some of the districts use this technology to track immunizations (Mobile 2015).

Medic Mobile intends to scale up the project in Nepal with the support of the Government and district health office. It has implemented the program with local-administrative and aiming to reach at higher levels of administration. It has also been testing direct approaches to join new features and encourage the users. These new features will be sustained to learning on the users as well as the low-skilled CHWs will be receiving continuous support and are keeping up in mind as well (Mobile 2015).

The implementation in Baglung district is a good example to start program. Local leaders are allocating funds to cover-up the costs of SMS. Medic Mobile will provide targeted support to initial districts implanting through 2027, the Government staff are implementing and managing these systems from the year 2018.

CHAPTER- 6 DISCUSSION

6.1 Introduction

This chapter discusses the finding of the data collection and the related literatures. The main objective of the study is to know how the implementation of m-health application has changed the lifestyle of the women; challenges of the rural communities to get health care facilities; and the opportunities gained from the implementation of Medic Mobile project in Baglung.

Nowadays, internet has become one of the most important part of everyday life. There are different purposes why people use internet but in the recent years use of internet for the treatment of the patients and communication and dissemination of the health-related issues has been widely in practice (Chu, Wang et al. 2017). Telemedicine is defined as "*use of communication and information technology to provide health care services to individuals who are some distance from the health care providers*" (Moffatt and Eley 2010).

Various studies have articulated telemedicine as cost-effective, availability of specialist healthcare in local community and time saving as patient do not need to travel long distance to get healthcare services. One of the major "*advantages of telemedicine over conventional care is the potential for increased access to medical care for populations that experience a level of isolation*" (Moffatt and Eley 2010).

Distance influences the delivery of healthcare, both in time and in quality (Combi, Pozzani et al. 2016). Therefore, use of ICT reduces the distance, in the sense, through the telemedicine technology specialist health professionals can talk with the patients in other places. Both developed and developing countries may encounter circumstances where the intercession time, from detection of disease to start of consideration, genuinely influences the last consequence of the consideration itself (Combi, Pozzani et al. 2016).

However, telemedicine applications in developing countries could be a use to provide essential healthcare services and to close the gap between provincial territories and specific doctor's facilities typically situated in urban areas (Daly, Horey et al. 2017). Particularly, countries with harsh geography as well as inadequate resources telemedicine has been an effective tool for reaching people in rural areas (Hassibian and Hassibian 2016). More specifically, telemedicine is an effective method to provide healthcare services to the populations in the rural and isolated geography or the population in most need.

6.2 Challenges of rural communities to access of healthcare

Success of any telemedicine projects depends on the availability of resources, proper planning, motivation of healthcare professionals and acceptance of the users**.** In Nepal, since early 1990s the government of Nepal has been implemented telemedicine one of the important intervention strategies for the healthcare of people living in rural areas. The government of Nepal and its different agencies, non-governmental organizations and the private sectors have been actively involved in telemedicine programs. But there are several factors which are challenging the easy access to healthcare to the population living in rural villages. The challenges of optimal utilization of telemedicine to improve healthcare facilities in Nepal can be discussed at various levels, namely, geographical, infrastructural, resources and societal challenges etc.

6.2.1 Geographical and infrastructural challenges

Nepal is a land-locked country situated between two big economy China and India. Nepal being a developing country, it has many geographical factors affecting the easy access to health care facilities. As about than 83 per cent geographic of Nepal is cover by mountain and hills, it has been one of the major challenges in easy access to healthcare (Ranjit 2016).

Baglung is situated in the western part of Nepal. The distance between the capital city Kathmandu and Baglung district is 275km west. The district is surrounded by Kali Gandaki river. The Baglung district is heavily suffered from monsoon season four months of the year and the other eight months it is dry and mostly sunny (Office of municipal Executive 2019).

Baglung bazaar (headquarter of the district) is the center for the healthcare facilities in district. Banks and finance companies, schools and colleges, hotels, hospitals are mainly

located in district headquarter (Office of municipal Executive 2019). The major source of livelihood of People in Baglung is agriculture. Baglung is a remote district in western mountain of Gandaki province. Due to difficult geography as well as lack infrastructure development transportation of people, good and services from village to district headquarter has been major challenge to access basic healthcare facilities (Office of municipal Executive 2019). The Kali Gandaki river rise during the monsoon making it difficult for the people to cross the river to seek for healthcare.

Infrastructures such as reliable electricity supply, well equipped hospitals, schools, road and transportation etc. are basic things to live a life. But people in rural municipalities of Baglung are still suffering from lack of all above mentioned infrastructures. Many people are deprived even from basic healthcare facilities. People needing healthcare needs to travel to cities. But, even in district hospital shortage of equipment as well as adequate numbers of healthcare professionals hampers the healthcare services.

As Central Bureau of Statistics Nepal, (2011), about 25 per cent population of Nepal live under poverty line, 80 per cent population live in rural areas. Rural municipalities in hill and mountain region of Nepal lack good road connectivity. Therefore, lack of access to good transportation facilities has made healthcare services expensive and time taking which rural poor people cannot afford. As one of the informants articulates;

> *Excess to hospital is very difficult for us. To go to nearby hospital takes 2-3 hours by the fastest route possible. Sometimes it is also not possible to reach within 3 hours. There are chances not to find doctors in the nearby health care centers. Since it is a rural district, qualified doctors and nurses do not show any interest to come and work in the villages. (Adult Woman 3)*

People in remote Nepal compel to travel many hours sometimes even some days to treat minor health issues. Therefore, rural people instead of visiting hospitals they prefer to seek the traditional healers that is known as witchcraft (Simkhada, Van Teijlingen et al. 2006). As one of the informants says;

> *Recently there was a case where a girl fell sick. She probably had some skin infection due to which she was itching her body hard. Instead of taking her to the health*

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centers or hospital, she was taken to Witchdoctors. They believe that these
Witchdoctors can cure all types of diseases. I think the lack of good health care
centers accompanied by socially practiced traditional beliefs are restricting people in
remote to seek modern health care services. (Adult Woman 1)

Similarly, lack of electricity has also been considered as one of the challenges in seeking healthcare in rural Nepal. Few years ago the Nepal Electricity Authority, a sole provider of electricity used to issue notice requesting consumers to use as less as electricity and in dry season country used to witness more than 16 hours of a day power outages, however in recent years the scenario has been changed and the state owned   power utility publishes advertisements encouraging people to use more electricity (Rijal 2019). But rural villages in Baglung are still suffering from lack of reliable source of electricity. The government of Nepal with the support of various donor agencies has been trying to connect rural villages with reliable source of electricity, but due to limited resources as well as difficult topography many of the village are still deprive of electricity supply (Rijal 2019).

In Nepal, technology itself becomes a major challenge in development and further expansion of telemedicine programs. Technologies are updated rapidly. But due to limited resources developing countries with limited resources cannot afford new technology (Bali 2018). In Baglung, reliable source of power supply and undisturbed and high frequency internet and telephone network is major issue to the successful implementation of Medic Mobile project. Recently, people's access to telephone in Baglung is growing rapidly, but majority of the rural population are still out of easy access to internet.

6.2.2 Resources related challenges

Effective implementation of telemedicine requires human and technological resources. The new technologies installed should be understandable and easy to use for older generations as well (Orlikowski 1992). To disseminate effective medical information the technology should support the accurate transfer of information (Chandwani and Dwivedi 2015). But in rural district of Nepal, lack of high-speed broadband internet as well as easy access to mobile network is a major challenge. As one of the respondents articulates;

Once, my daughter in law had pregnancy related complications at night. I tried to message to community health worker who used to visit our home to know about the situation of my daughter in law, but at that night messages were not being delivered. We were so worried all night. (Older Woman 1)

Marc Berg has mentioned that the designing an information system is not an easy task. The system should be designed as such the healthcare professionals as well as users should have a clear understanding about the system (Berg 1999). Implementation of Medic Mobile was not easy considering the level of people's awareness, low literacy rate and the socio-cultural boundaries.

The design of the mobile health application was not an easy task for the developers. But keeping on the user's satisfaction, availability of mobile phones, literacy rates of the district, developers designed the Medic Mobile's SafeSIM application. (Medic Mobile Project coordinator – Baglung district)

Decision- making process is also found to be a major barrier in the implementation of telemedicine (Adler, Pritchett et al. 2014). As Hirschheim mentioned healthcare professionals as well as user's clear understanding about the technology used on the program is crucial for success of the project. Thus, users participation and their positive reaction help in recognizing the successful implementation of an information infrastructure (Hirschheim 1989). As one of the informants articulates;

The first review of the users was kept in mind and further another version of mobile health application was developed by the IT specialists. (Medic Mobile Project Supervisor-Baglung)

There has been an immense interest in mobile health applications for the betterment of the healthcare systems in rural areas of Nepal. Different interventions have been included while implementing the m-health applications. For example- clinical decision support, community health workers (CHWs), data collection and other (Meyers, Filkins et al. 2017).

As Silsand and Ellingsen has mentioned that good clinical decision support system helps in improving the quality of healthcare, reduce the costs in healthcare and increase its efficiency

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(Silsand and Ellingsen 2016). M-health with good clinical decision support helps in improving the healthcare of the rural areas of Nepal and further helps in reducing the maternal mortality rate and child mortality rates.

> *People's increasing access to healthcare has helped to reduce maternal and child mortality rates in Baglung. (CHW 4)*

Health professional in Nepal are considerably overloaded. patient to doctor ratio is 1721:1 and 1 nurse for every 500 people (Panta 2020). Therefore, to motivate and involve health professionals in healthcare delivery through telemedicine need specific approach. Further, specialized hospital, medical colleges and doctors are basically situated in capital and other big cities such as in Pokhara, Bharatpur etc. which are far from the access to majority of the population as about 80 per cent population in Nepal are living in rural areas (Roodenbeke and Organization 2011).

6.2.3 Socio-cultural Challenges

The prevalent socio-cultural norms determines the health seeking behavior of the people (Chandwani and Dwivedi 2015). The traditional system of diagnosis delivered from local practitioners is usually adopted by the people in underserved communities. However, telemedicine intervention is based on formal system of medicine. Therefore, involving the local communities in designing and implementation of healthcare services is most crucial for acceptability of intervention (Chandwani and Dwivedi 2015).

Socio-cultural setting of a community determines the acceptance and sustainability of telemedicine programs. Cultural gaps between service receivers-patients and the service provider- healthcare professional, people awareness, ICT literacy and language etc. are major aspects which determines development and expansion of telemedicine programs (Bali 2018).

The success of telemedicine depends upon *"overcoming the socio-cultural barriers which relate to the prevalent institutional norms. It is important that a socio-technical perspective is adopted while designing the system, emphasizing the recognition of social infrastructure and configuration and incorporating elements that address potential contentions of technical and social aspects"* (Chandwani and Dwivedi 2015). So that it ensures the involvement of all the

stakeholders, such as policy makers, specialist doctors and other health professionals, coordination staffs and most importantly, the target community, from design to implementation (Chandwani and Dwivedi 2015).

In rural villages of Nepal, due to patriarchal values, women are treated as a low status in the community. Male members of the family mostly take the decisions regarding all the expenditures, healthcare, school fees, and many more (Kafle 2015). These reasons have affected the health of the women physically and mentally. In many cases although women do not prefer to visit witch doctors but due to the family pressure basically pressure from male member of the family, they have to visit witchdoctors instead of visiting healthcare professionals. Lack of freedom to women have restricted them to access the information about the world and their health (Simkhada, Van Teijlingen et al. 2006).

There are many health issues in rural villages of Baglung district. Child marriage, early motherhood etc. are some of the factors affecting health of women. Until early 2000s practice of child marriage was prevalent. Although, practices of child marriage have been gradually decreasing but it is still prevalent in certain caste and ethnic group in some rural village in Baglung. The factor for women to get married at an early age is lack of education, work status, caste, socio-economic status (Aryal 2007). As one of the informants articulated;

> *I got married at the age of 14. I had my first child immediately after marriage. It was a tradition before to get married early. (Older Woman 1)*

Gender based inequalities are still highly privileged in rural parts of Nepal. Education, social, cultural disparities are in practice. Basically, men are regarded as people with high status and are offered more privileged in society. And on the other hand, women are bound to stay at home even with same level of education. Particularly in rural areas, many daughters are deprived from basic education, rights to assets and decision making. They are destined to work household and help in the agriculture and farming (Luitel 2001).

Superstitious social values and illiteracy are other causes affecting the health of pregnant women. The lack of awareness of contraception, unsafe sex, etc. have cause the large amount of child mortality in Nepal. People's illiteracy has caused deaths of the mothers and their

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child. Visiting the witch doctors, unhygienic environment, nutritional deficient pregnancy has always been a major factor for maternal and child mortality. As one of the informants says;

> *All the decisions in the family is done by my husband or mother-in-law. My children and me myself are either staying at home or doing the household chores. My daughter sometimes goes to school. Education is less priority to daughters than sons. (Adult Woman 3)*

6.3 Advantages of Medic Mobile on Local Communities

M-health has been used world-wise in improving the healthcare and has shown great improvement in child and maternal mortality rates, immunization and many more (Sharma, Harsha et al. 2015). In the context of Nepal, implementation of Medic Mobile has trained Community health workers to use mobile phones and data collection where there has been shown around 94% of accuracy rates. These improvements help in maintaining the health status of the community and help in reducing the mortality rates (Sharma, Harsha et al. 2015).

The clinical decision support system helps in better understanding of the system implemented and helps in improving the healthcare system and needs essentially reducing healthcare costs (Silsand and Ellingsen 2016). Decision support system in Medic Mobile helps in reducing the travel costs of the people and thereby improve the healthcare facilities. One of the informants shares her experience as,

> *Before the cost of healthcare was expensive and there had been problem for us to travel to healthcare centres. It was more expensive to travel than to seek basic healthcare facilities. (Adult woman 4)*

The implementation of the successful information system such as m-health should be understandable, and the designs must be easy to use by the users. Different problem may arise while designing an information infrastructure system in the field of healthcare (Berg and Goorman 1999). The first version of Medic Mobile was difficult and not well understood by the users. The complicated situation of understanding the code and other system in mobile phone application was the feedback gained from the users.

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As one of the informants mentioned,

> *The mobile health application was difficult for me to understand and record the information to the CHWs supervisors. The text which was needed to be filled was not understood by me and many times wrong information was filled up. (CHW 2)*

The information infrastructure system should be as simple as possible. It helps in creating the positive networks between the users and designers. The solution to the problem should be analyzed from the view of the consumers (Aanestad and Jensen 2011). The second version of Medic Mobile's mobile phone application was designed after the review from the consumers and CHWs. It was designed in order to fulfill users' satisfaction and understandable designs implementations.

One of the informants shares her views as,

> *The first version was very hard for me to understand and since I have basic education, I was not able to understand the English texts. The second version of mobile health application was far much better than the first one. It was easy, understandable and I was trained to use it. (CHW 4)*

Work-oriented infrastructure is based on improving the technology, working environment and providing the services. The designs to be implemented should be made user friendly in practice to the healthcare (Hanseth and Lundberg 2001). The project at Baglung district designed the mobile health application user friendly and easy to understand by the users.

Men are also slowly involving themselves in the maternal health and well-being of the women. Men are the primary decision maker of the Nepalese society, their involvement in the maternal health could be another step towards the women empowerment. The affordable services and improvement in communication and transportation could even improve the emergency pregnancy care.

Implementation of Medic Mobile helps in reducing the complication throughout pregnancy. The complicated pregnancy of a women has always been traced by the CHWs and further by

CHWs supervisor. Any complications occurring to the pregnant women would give the CHWs a remainder and those pregnant women are specially taken care of.

Medic Mobile has made the pregnant women to easily access the healthcare professionals in any case of emergency. The *SafeSIM* scheme of Medic Mobile has assured the CHWs and pregnant women to regularly visit the healthcare centers and gain information regarding pregnancy.

The CHWs have been given training to handle the emergency situation of the pregnant women. The remainders about the pregnant women are regularly checked and analyzed by the CHWs and further the information is passed over CHWs supervisor who further pass the case to healthcare professionals.

The pregnant women in Baglung districts are regularly supervised and tracked by the CHWs. They visit and reports the data about the pregnant women and passes the information to the CHWs supervisor. CHWs regularly visits the pregnant women and keep a track about their pregnancy. All the data about the pregnant women has been analyzed and routine check-ups have been done by the CHWs.

The CHWs supervisor regularly keeps the data of the pregnant women updated and helps the CHWs to further maintain the work process regarding all the pregnant women of Baglung districts. In any case of complication, the CHWs supervisor call upon the healthcare professionals for further enquiry or visit at the hospitals.

Emergency cases of pregnant women at Baglung districts are sent to the specialized urban hospitals with the help of Medic Mobile. The CHWs and CHWs supervisor maintains all kind of data about the pregnant women and specializes the case about them. These improvements have helped the pregnant women in Baglung districts a lot and have also reduced the maternal and child mortality ratio.

6.4 Implementation of m-health and changes in the lifestyle of women

Women's situation in rural Nepal lags far behind than men (Mahat 2003). They have low access to education, healthcare, socio-economic and political status in the country (Adhikari, Soonthorndhada et al. 2009). There has been a low-level increment in the socio-economic

status of women in Nepal. The higher maternal mortality rate is prevalent due to early marriage and poor health services (Mahat 2003).

There have been many cases where unintended pregnancy occurs leading to early pregnancy aged 15-20 years age group. Rural Nepal deprived of enough healthcare facilities and early motherhood has led to high maternal and child mortality rates. The high illiteracy, working in agricultural sector, lack of awareness and living standards in rural areas have been the main reasons behind high mortality rates of women (Adhikari, Soonthorndhada et al. 2009).

In Nepal, particularly in Baglung district pregnant women have experienced changes in their lifestyle after the implementation of Medic Mobile. This new step towards the development of the rural village and district has brought a light to bright future of women in rural communities. Most of them found this telemedicine services feasible and reliable also.

Early pregnancy is also the main reason behind the maternal and neonatal mortality rates in Nepal. Maternal mortality was very high a decade back in Nepal but slowly it has been decreasing. In Baglung, most of the women were married and were around the age between 18-30 years. And among these ages' women, most of them already had one or two children. Most of them were even pregnant with their third child.

Lack of communication between the patient and the healthcare professionals has created a huge gap between them in many cases. The insecurity to talk with the healthcare professionals have driven the health status of Nepal below. There is a strong expectation between the patients and healthcare professionals to give adequate amount of time, gain information regarding diseases and vice versa (Moore 2008). These expectations do not meet in context to women in remote and rural areas of Nepal. Interpersonal communication relationship is one of the complex ones between patients and healthcare professionals (Ong, De Haes et al. 1995).

Women in Baglung have found themselves safe and aware about the pregnancy and themselves. The awareness program conducted by CHWs has helped them to analyze and identify the pregnancy risk complications. The usage of mobile phones to gain health related information has been slowly increasing in all parts of Nepal including Baglung district. The

services provided after the implementation of Medic Mobile has improved the quality of life of the pregnant women.

The regular remainders of the antenatal counselling, antenatal visits, emergency call, alert, delivery remainders, birth, postnatal care, postnatal counselling visits and many more has helped a lot in reducing high risk of maternal mortality rate. The supervisions of the CHWs and Medic Mobile team over them have changed the lifestyle of women in Baglung and many other rural districts of Nepal.

The risk of pregnancy is always high in the rural parts of Nepal. Timely contact to the healthcare professionals, regular visits to healthcare centers, identifying the complications of pregnancy help in preventing the maternal death and helps in improving the good condition of the newborn (Simkhada, Van Teijlingen et al. 2006). The work done by CHWs in Baglung has been a step forward towards reducing high risk pregnancy situation.

The trend to give birth at home, which had been in practice in many rural parts of Nepal has been slowly decreasing. The regular visits of CHWs has allowed and encourage the pregnant women to give birth at the health facility rather than at home. Still there are many women who wish to give birth to the child at home. They call upon the trained CHWs and under their supervision they give birth to the newborn.

The women in Baglung has improved themselves a lot in the period from 2015 until now. Pregnant women find themselves comfortable to talk and communicate to CHWs than before. Men involvement in routine check-ups, follow-up and all the basic services needed for the pregnant women has changed the whole lifestyle of the pregnant women in Baglung.

Community health workers provide an important health services to the people in rural Nepal where it is very difficult to find proper healthcare with limited access to healthcare professionals. Nepal being a developing nation has mobilized over 5o thousands community health volunteers (FCHVs) which help in providing care to patient in healthcare centers as well as by home visits and had been spreading awareness regarding contraceptives and pregnancy-related issues (Sharma, Harsha et al. 2015).

In1990s Government of Nepal prioritizes the MMR and involved in *National Safe Motherhood and New-born Health Long-term Plan* from 2002-2017 which mainly focuses on the development of facilities to pregnant women and also providing emergency obstetric care (Engel, Glennie et al. 2013). The eight Millennium Development Goals (MDG) in 2000 forced the project to success in reducing the maternal mortality rate.

The second long-term health plan 1997-2017 conducted by the Ministry of Health has major focus in reducing the maternal mortality rate to 250 per 100,000 live births by 2017. Most of the deaths occur due to complications of the obstetric, skilled birth attendants (SBA), no emergency services and required equipment in rural areas of Nepal (Simkhada, Van Teijlingen et al. 2006).

*According to 1996 Nepal Family Health Survey (NFHS), the maternal mortality ratio (MMR) was 539 per 100,000 live births. Around three-quarters of maternal deaths were due to direct obstetric causes, two-thirds occurred after delivery, and about one-third occurred during pregnancy and two-thirds occurred in the community (*Sharma, Sawangdee et al. 2007*).*

The benefits of using the e-health techniques include access to education, cost-effectiveness, efficacy, learners' interaction (Sinclair, Kable et al. 2016). Telehealth in this area has support with the positive trend managing the emergency services and ambulance (Winburn, Brixey et al. 2018).

The regular visits of CHWs to the home of each individual and recording the data has been helpful in reducing maternal mortality rates. After the implementation, the rate of women giving birth to the child in healthcare centers and hospitals has unexpectedly increased due to which Medic Mobile expanded its project to other villages. They have helped the expected mothers with the guidelines and awareness program. The CHWs even visit the mother after the delivery of the child to assess the danger signs of the newborn and low birth weight.

CHAPTER 7: SUMMARY, CONCLUSION AND RECOMMENDATION

The present study has examined the role of Medic Mobile project on improvement of maternal and child health in Baglung district, Nepal. The study specifically has highlighted the various challenges to easy access of healthcare to the population living in rural areas. Understanding the various dimension of maternal and child health, it has also tried to identify the opportunities gained from implementation of telemedicine programs, and changes on women lifestyles in rural Nepal.

This study started with background information and the history of telemedicine in Nepal and its link to maternal and child health. The next chapter offered some theoretical framework for the study to highlight how various approaches of telemedicine are linked to the issues of maternal and child health. The chapter 3 presented the research setting, the context or a broader picture of Nepal. The chapter 4 outlined a methodological framework, more specifically tools, techniques, opportunities and challenges of the study. The chapter 5 is about case, which outlined the overall picture of Medic-mobile project and its implementation in Baglung. On the background of previous chapters, Chapter 6 offered discussion of the study.

This chapter presents the summary of major findings. It also articulates present scenario of telemedicine in Nepal and how Medic Mobile programs have been driving force to change the healthcare of rural population in Nepal. Moreover, this chapter will also attempt to recommend some areas for further study aiming to establish telemedicine as an important field of study in healthcare sector.

7.1 Summary of Findings

Though the Constitution of Nepal has ensured healthcare as basic right of every citizens of Nepal no matter of what background and the geography of the residence, a large number of people have been deprived of basic healthcare facilities. The government of Nepal, its different agencies, NGO and INGOs and private sectors have been involved to provide healthcare services. However, people's deprivation of basic healthcare has seriously challenged the constitutional provisions. This thesis tried to understand the role of telemedicine on rural people's access to healthcare. This study attempted to understand a)

rural people's perspectives on access to healthcare, and challenges; b) opportunities gained from telemedicine project, and c) changes on lifestyle of women more specifically through implementation of Medic Mobile. The following section presents the summary of the findings.

7.1.1 Rural women and challenges of access to healthcare

One of the major issues was to how women in rural villages have been suffering from lack of access to healthcare facilities locally. Despite the constitutional provisions, women in rural villages of Baglung have to deprive from quality healthcare. There are several factors, which have barred women's easy access to healthcare.

Baglung is a remote district, which lies in western hill of Nepal. Majority of households rely on agriculture. Baglung bazaar is a district headquarter which itself is center for the healthcare facilities in the district. School, college, bank, finance, hotel and hospitals are mainly located in the Baglung bazaar. Difficult geography as well as lack of infrastructural development such as lack of all-season road access to district headquarter has been challenging the rural people's access to healthcare. Successful implementation of any telemedicine project depends on available resources. However, lack of reliable source of electricity, lack of high-speed broadband internet as well as easy access to telephone and mobile network have emerged as the major challenges. Health professionals in Nepal are considerably overloaded. Therefore, to motivate health professionals in telemedicine needs specific approach.

Socio-cultural setting of a community determines the health seeking behavior of the people. However, Baglung district lies in the category of districts with low literacy rate. People in rural villages believe more on traditional form of cure- the witchdoctors. Men's domination on household or family decision-making has been restricting women to visit hospitals. Even if women tend to visit healthcare centers to consult with doctors, family pressure compel them to choose traditional healers.

7.1.2 Medic Mobile's impact on lifestyle of women

Despites various challenges, Medic Mobile has brought several opportunities and positive changes in women lifestyle in Baglung district. Illiteracy has always been a major challenge in the implementation of the mobile health applications. Women in Baglung district are mostly involved in the household chores, agriculture and helping to husband's business. Even at times of pregnancy, they used to prefer visiting traditional healers. After implementation of Medic Mobile project, they had gradually shown interest in talking to CHWs, shared data, updated their health status, took medical advice, etc. The trend of delivery at home, which has been in practice for longtime, had slowly decreased. Regular visits of CHWs, their advice and monitoring through mobile tech led to overall improvement of pregnant women.

Even women started seeking health information about themselves as well as for their family members. Mobile applications help in the healthcare delivery and awareness about the pregnancy-related complications. The reminder system available in the software has supported to achieve of the desired goals in the program area.

Further, changes on women's status is another noticeable achievement of Medic Mobile program. Women who were limiting themselves in four walls of household chores gradually began to come out and participate in family as well as social affairs. The regular visits of CHWs have encouraged rural women and they are more open and comfortable with CHWs. Men's perception about women, their role and responsibilities has significantly changed. Even men slowly began to support their spouses for routine check-ups and follow-ups.

7.2 Conclusion

The overall objective of the study was to find if the telemedicine project implementation has positively impacted pregnant women and children lifestyle in rural areas. In Nepali medical sector, telemedicine has proved one of the best alternative sources of healthcare particularly for people living in rural areas. Nepal can further accelerate, expand and incorporate this new method in its official healthcare system. It can be a highly beneficial tool to support for a wider section of the people living in rural Nepal, who have to face inadequate infrastructure and specialist health professionals. The general finding of this study also proved that the implementation of m-health technology could play a significant role to improve the health

status of women. It has also played an important role to bridge a gap between cities with specialized hospitals and rural areas.

However, there are several other constraints while considering access to healthcare through m-mobile services. Lack of electricity, availability of smart devices, high cost of internet and lack of mobile literacy have forced local people to opt out this service in many cases. In many cases, rural women cannot handle their devices properly, and understand the technical jargon used by health professionals. Likewise, socio-cultural norms and values have barred to rural women to talk freely in mobile devices with unknown person.

Ignoring the socio-technical factors may hinder for the smooth implementation of m-health program in rural Nepal. Continuous upgradation and changes of technology may create confusion with the people. While designing the m-health software, it must take note of the status of rural people, their mother language and literacy. Simple and easily understandable technology and content can benefit a large section of the society. A robust user manual, training, immediate feedback, reliable technical support system, and guarantee of privacy protection greatly help to smooth operation of m-health.

7.3 Recommendation

Implementation of Medic Mobile program has brought many positive changes on health of pregnant women in Baglung. Women who used to be limited into four walls of household chores have started seeking health services available in the community. Due to community health worker's continuous effort, pregnant women are more open to share their health issues. The program further expanded to other districts as well. Initially, the project had incorporated 77 CHWs. After examining the effectiveness, it was further expanded to other neighboring villages.

Finding of the study shows that implementation of Medic Mobile project in Baglung was not free from challenges. Topography, lack of infrastructure, inadequate physical and human resources, low literacy and patriarchal social values were some of major challenges. Initially, the project had struggled to change perception of local people about Medic Mobile project. The local people were more suspicious toward new technology and they had more trust with

traditional healers. Nevertheless, tireless effort as well as motivation of community health workers helped to change perception of local community.

Therefore, intervention of telemedicine programs could be an effective means to reduce health-related challenges of women and children in rural areas. The government must mainstream and own this technology into country's public health system and assure regular budgetary support. Even government can formulate a policy that will encourage using this service, ensuring cheaper internet facility and tax concessions. The mobile health data itself will help government to further design country's overall public health plan and policy.

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