Telematics and Informatics xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Telematics and Informatics

journal homepage: www.elsevier.com/locate/tele

Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal

Rajan Parajuli *, Philippe Doneys

Gender and Development Studies, School of Environment Resources and Development, Asian Institute of Technology, Bangkok, Thailand

ARTICLE INFO

Article history:
Received 14 February 2017
Received in revised form 15 May 2017
Accepted 16 May 2017
Available online xxxx

Keywords:
ICTs and healthcare access
Telemedicine
Gender
Nepal
Mobile phone-based telemedicine
Video conference-based telemedicine

ABSTRACT

In this study, we explore the role of telemedicine in reducing gender-based barriers women and girls in rural areas of Nepal are facing to access healthcare services. Data were collected through a mixed method consisting of questionnaires survey, in-depth interviews, and focus group discussions with mobile phone and video conference-based telemedicine users. Data were analysed through descriptive and thematic analysis. Results revealed that 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. The conclusion is that rural telemedicine tends to reduce gender-based barriers for women and girls in accessing healthcare services. Finally, policy recommendations are provided for expanding these initiatives in rural areas.

1. Introduction

Telemedicine, which refers to the delivery of healthcare services from a distance using information and communication technologies (ICTs), has been expanding in developing countries in recent decades. The technology has been noted for overcoming geographical barriers to access and deliver healthcare services to people living at geographically remote and inaccessible regions (Ecken et al., 1997).

Several studies have noted the influence of gender-based barriers on women's and girls' access to healthcare services in rural areas (Afifi, 2007; Ensor and Cooper, 2004; Khan, 1999; Mumtaz and Salway, 2005; World Health Organization, 2010). Gender-based barriers refer to the obstacles created based on gender dynamics, often stemming from inequalities, which impact men and women differently in society. These obstacles create travel restrictions for women and girls, limit their access to a source of income, and undermine their ability to participate in important household and community decisions and activities.

Though studies have highlighted the role of gender-based barriers in accessing healthcare services, little is known about the influence of telemedicine in overcoming these gender-based barriers. Feminist technology researchers argue that men tend to have more control over technologies (Faulkner, 2001; Grint and Gill, 1995; Wajcman, 2009). This would suggest that delivering healthcare services through telemedicine might not improve women's and girls' access to healthcare services due to their lower social positions in relation to technology. Until now, a substantial number of telemedicine studies are focused either on the clinical or technological dimensions and seem reluctant to shed light on the social aspects of telemedicine. As

* Corresponding author at: Gender and Development Studies, Asian Institute of Technology, P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand.
E-mail addresses: Rajan.Parajuli@ait.asia, rajankavre@gmail.com (R. Parajuli).

http://dx.doi.org/10.1016/j.tele.2017.05.006
0736-5853/

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

such, this study aims to explore the gender dimensions of telemedicine with regards to improving access to healthcare services in rural Nepal.

2. Literature review

The literature review will further present a rationale for the study while reviewing studies and documents relevant to our research. It therefore presents a discussion on access to healthcare that is important to consider in a developing country context. We reviewed related literature and more specifically studies focusing on the gender-based barriers to accessing healthcare since telemedicine is often presented as a solution to increase access to healthcare services. This should help provide an analytical lens in terms of understanding changes to healthcare access generated by the introduction of telemedicine. This is followed by a discussion of telemedicine in Nepal and the specific advantages (and shortcomings) of using telemedicine in rural areas.

2.1. Barriers in access to healthcare

Several barriers are hindering women's and girls' access to healthcare services; among them, studies have highlighted geographical, financial and socio-cultural factors as key barriers to access healthcare services. Penchansky and Thomas (1981) have categorised availability (service and facilities), accessibility (travel time to the service centre), affordability (direct and indirect cost for services), acceptability (socio-cultural factors), and accommodation (quality of services) as key barriers hindering access to healthcare services. Later, Millman (1993) viewed barriers as being structural (number, types, concentration, location, and organizational structure of the service providers), financial (ability to pay for the required healthcare services) as well as personal and cultural (acceptability, language, attitudes, and education). Similarly, Wang and Luo (2005) described barriers as spatial (geography and travel time) and non-spatial (socio-economic and demographic). In a more recent study, McIntyre et al. (2009) discussed physical, financial and cultural determinants of access to healthcare services. Besides these studies, more attention has been paid to the social determinants of health, which represents individuals' social, economic, and life conditions. Where people are born, grow, live, and work are believed to be important reasons for health inequalities (Braveman et al., 2011; Marmot et al., 2008). As a social determinant of health, gender is also considered an influential factor for health inequalities and uneven access to healthcare, particularly in developing countries (Men et al., 2011; Sen and Ostlin, 2008).

2.2. Gender-based barriers in accessing healthcare services

Research has identified travel restriction, access to and control over financial resources, and household chores as key gender-based barriers for women and girls to access healthcare services (Avotri and Walters, 1999; Balarajan et al., 2011; Khan, 1999; Mumtaz and Salway, 2005). Studies conducted in rural Pakistan found that access to healthcare services by women and girls is largely controlled by men. While this control is less stringent if women and girls access health services inside their village, it becomes very strict when they travel outside. Compared to women, travel done by girls was found to be under even greater control by men (Khan, 1999; Mumtaz and Salway, 2005).

Other than travel barriers, studies have highlighted traditional gender norms as a key determinant of women's access to and control over financial resources. In India, women and girls experienced greater difficulties than men to arrange expenses, which is a prerequisite to access healthcare services (Balarajan et al., 2011). Women's and girls' limited access to financial resources leads to delay in getting healthcare services (World Health Organization, 2010). Also, traditional family responsibilities, such as caring for children, preparing foods, fetching water, collecting firewood and other family needs restrict women's and girls' ability to manage time for their health (Avotri and Walters, 1999). Additionally, gender roles and norms also hinder women and girls from accessing formal education or health information, and engaging in political participation (Buor, 2004), which contributes towards poor health because of deleterious behaviors and unsupportive policies (Feinstein et al., 2006).

2.3. Telemedicine in Nepal

Nepal is a mountainous country where 83% of the land is hills and mountains (Baral, 1986). Telemedicine was introduced in Nepal in 1998 in order to reduce casualties from mountain climbing by monitoring vital signs at the Everest base camp through satellite connection with Yale University (Angood et al., 2000). Since then, government and non-government organizations in Nepal have spent nearly two decades developing and implementing various telemedicine solutions. As such, nearly all of the current Nepalese telemedicine initiatives are running on a non-profit basis and offering telemedicine services free of charge. Two types of technologies in particular have been used; real-time video conferences using standalone or web-based video conferencing devices and mobile phones for voice-based consultations (Nepal Mountain News, 2011; Pandey, 2012). Currently, five hospitals provide regular video conference-based telemedicine services with a dozen of rural health posts. In addition, two mobile phone-based telemedicine services are operating (Kathmandu University, 2015). The video conference-based services are primarily focused on assisting local health workers in diagnosing difficult cases as well

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

as consulting directly with patients in the presence of such health workers. Services over mobile phone deliver mostly primary healthcare, such as basic treatment advices and necessary health information to rural people. Telemedicine has also been used to share clinical knowledge on a regular basis between specialists and health practitioners located at rural health posts (Rai, 2013).

2.4. Promises and shortcomings of telemedicine for rural people

A review of the literature provides us with many advantages offered by telemedicine services for rural people. A systematic review of 143 telemedicine papers based in rural Australia has found that there were benefits through reduced expenses and inconveniences, improved quality of rural clinical services, increased access to necessary health information, and minimised families' social dislocation. Further, the review argued, based on these papers, that telemedicine improved access to specialist services, strengthened remote specialist support to local clinicians, as well as improved follow-up and timely treatment of illness (Moffatt and Eley, 2010). Similarly, Norris (2002) found that telemedicine reduces travel and time for essential medical services; it also ensures better contact with a specialist who may not be available locally. Likewise, studies have found that telemedicine services have reduced the cost of treatment in rural areas (Ivatury et al., 2009; Kifle et al., 2006). Aside from the advantages, shortcomings related to infrastructural issues, such as infrequent Internet connection and the lack of uninterrupted electricity, are reported in the literature (Ganapathy et al., 2016; Moffatt and Eley, 2011; Subedi et al., 2011). In addition, rural telemedicine initiatives in developing countries have problems sustaining their activities on the long run because of the lack of regular funding sources (Piya, 2010).

Less attention has been given to the social impacts of rural telemedicine, especially the impacts it may have on gender-based barriers to accessing healthcare services in the context of a developing country. Though women and girls are enrolled as respondents in telemedicine studies, these studies tend to be more focused on illness (Dalfra et al., 2009; Magann et al., 2011; Solberg et al., 2003) rather than the social dimensions or impacts of using those technologies. Gender dimensions, more specifically, are not assessed in relation to rural telemedicine in current telemedicine studies though gender-based barriers have been identified as affecting access to healthcare services, especially for women and girls in rural areas (Khan, 1999; Mumtaz and Salway, 2005; Sen and Ostlin, 2008; World Health Organization, 2010). Hence, this study aims to explore the role of telemedicine in overcoming gender-based barriers that affect access to healthcare services.

3. Methodology

3.1. Research design and methods

We employed a mixed method research design so that we can explore and explain the research problem. A mixed method, which includes qualitative and quantitative data, helps us to complement findings and triangulate, and in turn validate the data from different sources. Hence it is more likely to find a more convincing answer to a research problem (Creswell et al., 2003).

We obtained records of mobile phone and video conference-based telemedicine users from two hospitals based in Kathmandu and three rural recipient sites respectively to find respondents for this study. Women and girls who used video conference-based telemedicine services before January 2015 and those who received mobile phone-based telemedicine in January of the same year were considered as a frame population for sampling. From a total of 175 (88 video conference and 87 mobile phone-based) telemedicine users, we obtained 94 as a required sample size at 95% confidence level with 7% level of precision (Yamane, 1967). Then, we applied simple random sampling by generating random numbers with Microsoft excel which was then sorted lowest to highest and finally, we surveyed the first 94 respondents from the list, ending with 48 video conference-based users, and 46 mobile phone-based users as respondents. We adopted purposive sampling for the 16 in-depth interviews.

Video conference-based telemedicine users were first surveyed using closed-ended questionnaires which contained dichotomous, multiple choice and five-point Likert scale questions comparing the periods before and after the introduction of telemedicine. The survey was followed by in-depth interviews with telemedicine users to explore more 'how' and 'why' questions in depth, and in narrative form on the same time periods. Both the survey and interviews were conducted using a single interviewer. After the survey and in-depth interviews, we conducted three focus group discussions, one in each video conference-based telemedicine recipient site, to collect information and experiences shared by telemedicine users as a group and further support a triangulation of the survey and in-depth interview responses. Local telemedicine facilitators helped select a representative group of eight women and girls for focus group discussions in each site. Using a discussion guide, one of the authors of this paper moderated all three focus group discussions, while notes were taken by an assistant moderator, and discussions were audio recorded with prior consent. Similarly, we also carried out key informant interviews with a local network provider, the chiefs of three local health posts, the head of three villages, the head of three local mother's groups, two principals from nearby schools, and with an officer at the department of health. Similarly, mobile phone-based telemedicine users were surveyed and interviewed using a telephone as most of these respondents were from different districts.

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

We followed the APA ethical guidelines as an Institutional Review Board has not yet been established at our institution. We obtained verbal consents from all the research respondents and kept their identity confidential while processing and reporting the data.

3.2. Data analysis

We analysed quantitative data using descriptive statistics, while for qualitative data, we applied thematic analysis as described by Braun and Clarke (2006). The results of both data sources were used to complement and expand the findings.

4. Results

This study aimed to explore the influence of telemedicine on women's and girls' gender-based barriers in accessing healthcare services in rural Nepal. The results are based on responses from women and girl telemedicine users who received telemedicine services using either mobile phones or videoconference.

4.1. Profile of the respondents

The characteristics of research respondents are presented in Table 1. The majority of respondents are between 17 and 36 years old. Among these women and girls, 71.3% are married while others are single or widowed. Agriculture is a major occupation (44.7%) of the telemedicine users followed by homemaking (20.2%) and studying (17%). Notably, the vast majority of telemedicine users (78.7%) have an education level of less than grade 12; and a minority (13.8%) is illiterate.

Table 1
Characteristics of respondents.

Profile	N = 94	%
Age		
16 and below	7	7.4
17–26	37	39.4
27–36	26	27.7
37–46	11	11.7
47–56	8	8.5
57 and above	5	5.3
Marital Status		
Single	24	25.5
Married	67	71.3
Widow	3	3.2
Divorced	0	0.0
Separated	0	0.0
Occupation[*]		
Agriculture	42	44.7
Services	8	8.5
Business	5	5.3
Students	16	17.0
Homemaker	19	20.2
Others	4	4.3
Education		
Illiterate	13	13.8
School level	74	78.7
Undergraduate	6	6.4
Graduate	1	1.1

[*] Indicate occupation percentages are based on multiple-answers, thus calculated on total responses.

4.2. Telemedicine and women's and girls' travel-related restrictions

Telemedicine addresses the issue of distance to healthcare services and hence helps circumvent travel related restrictions in accessing healthcare services for women and girls by reducing the frequency of travel to district or city-based hospitals. Before the availability of video conference-based telemedicine services, women and girls usually had to travel two, three or even four times in a year to district or city-based hospitals. However, this has been reduced mostly to a single visit after telemedicine interventions (Fig.1).

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

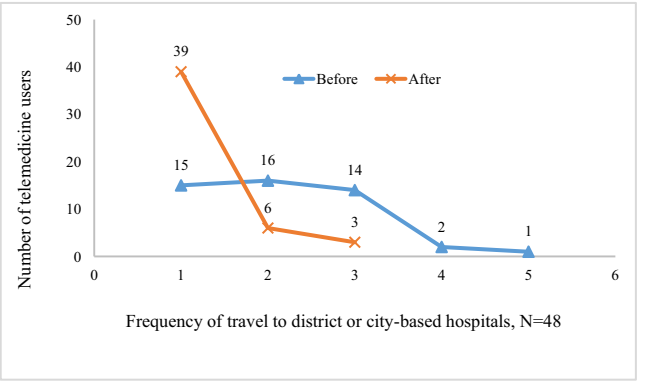

Fig. 1. Annual frequency of travel to district or city-based hospitals before and after the video conference-based telemedicine services are available.

The line graph suggests that the frequency of travel to the district or city-based hospitals has reduced considerably after telemedicine services were available. Travel frequency went from 2.13 (SD = 0.98) to 1.25 (SD = 0.56) indicating that after accessing telemedicine services women and girls are visiting district or city-based hospitals fewer times as they are obtaining better medical services through telemedicine in their villages.

We found that 86% of video conference-based telemedicine users now travel less than a kilometre to receive healthcare while mobile phone-based telemedicine users do not need to travel to obtain healthcare. This has considerably reduced travel time in order to obtain healthcare. Out of 16 in-depth interviewees, 14 said that travelling outside their village is not easy for them. Usually women and girls require permission or a companion to travel to the district or city-based hospital, as a 44-year-old video conference-based telemedicine respondent reported:

> "Travel outside the village is difficult for us if we compare with men. Though travel for health reasons is comparatively less restricted than other reasons, it is hard to get approval for travel for common and mild illness as, regarding treatment, even if not directly opposed by men, the men suggest to wait and see in few more days."

This suggests that family permission and travel distances are interwoven in restricting women's and girls' ability to travel. However, families pay less attention when a woman is travelling nearby, as a 20-year-old video conference-based respondent stated:

> "Travelling nearby or day-long travel is not problematic to manage, but if it requires few days then obviously family permission is needed."

The impact on distance is something a 50-year-old male key informant noted after telemedicine was introduced:

> "Telemedicine has reduced the distances to the health centre. Women and girls are less restricted to travel nearby thus they are obtaining the necessary healthcare services with fewer travel restrictions these days."

Even when women and girls obtained consent to travel, staying a whole night outside was difficult for them as a 20-year-old video conference-based respondent stated:

> "If our treatment required overnight stay and there is no companion, then in many instances, we might be questioned by senior family members or husband."

These permissions and distances-related issues sometimes discourage them in seeking treatment for common and mild illnesses as an 18-year-old mobile phone-based telemedicine respondent stated:

> "Travelling outside the village is not easy for women. Different gossips spread when we regularly go for common, mild sickness, and cases [illness] that don't appear in our faces, now I find much ease because of the mobile phone-based telemedicine."

4.3. Telemedicine and women's and girls' time management for household chores

The survey data shows that household chores are performed mostly by women though men are also helping with few household chores (Table 2).

Table 2
Men and women's involvement in doing household chores.

Involvement of men and women in doing household chores	Video conference-based		Mobile phone-based	
	f	%	f	%
Women carried all the household chores	18	37.5	26	56.5
Men carried all the household chores	0	0	0	0
Men help with few household chores	30	62.5	20	43.5
Total	48	100	46	100

Nearly three-fifths of mobile phone-based telemedicine users (56.5%) and almost two-fifths of video conference-based telemedicine users (37.5%) stated that women carried all the household chores. Though there are some differences in replies between mobile phone and video conference-based users about the help men provide with household chores, no one reported that men carried all the chores, suggesting that social norms tend to view these chores as more appropriate for women.

This is relevant to our discussion as interviews suggest household chores are also a barrier in terms of receiving healthcare on time. Doing more household chores ultimately prevent women and girls from travelling to district or city-based hospitals. A 20-year-old video conference-based respondent suggests that delays lead to more complications:

> "Though we are willing to get treatment on time, the responsibilities do not let us travel promptly, most of the time we were taken to hospital when our medical condition became severe."

In many instances, treatment becomes impossible if nobody in the family is there to look after children. Another 34-year-old video conference-based respondent said:

> "For a couple of years, my husband has been working in Malaysia. He was supporting me to take care of children and agriculture-related work, but now there are no helping hands; I have to take care of my three small children and all my household tasks, including seasonal agricultural activities. In this situation, it is practically impossible to walk many hours for treatment leaving the children unattended at home."

Men's help with household chores has been limited thus women have to take more responsibilities. A 31-year-old mobile phone-based respondent said:

> "Men said household chores are not their task; therefore I find myself stuck with chores, farming, and caring for children."

After the introduction of telemedicine, respondents reported having time for both household chores and accessing essential healthcare services. A 30-year-old video conference-based respondent stated:

> "Things are easier these days. I do not need to think much about household chores as a consultation finishes within 15–20 min, which is easy to manage. Even during busy hours, we can comfortably manage our time."

For mobile phone-based telemedicine users, travel is not required to consult with a remote doctor. It allows them to call a doctor when they are free, usually before going to sleep at night. A 24-year-old mobile phone-based respondent said:

> "Even if I am not able to manage time due to our household routines, I can easily get connected to a doctor at night time, which is a relatively comfortable time for me."

Confirming the above quote, a doctor at the mobile phone-based telemedicine provider site remarked that they receive many calls during the evening as well as night time:

> "It is a bit difficult to say for sure that women and girls do more calls at night time as we do not record their details, but we can say that we receive a considerable number of call at night time as well."

Therefore, telemedicine facilitates access to health services because household chores, a responsibility mostly done by women, are not interrupted or affected by the shorter time needed, either because of shorter distance or being at home when using telemedicine services.

4.4. Telemedicine and financial barriers

We asked telemedicine users to express their level of agreement on whether telemedicine reduces medical expenses on a five-point scale. The results presented in Table 3 show that a very high number (87.5%) of video conference-based telemedicine users strongly agreed, while the rest somewhat agreed (12.5%), that telemedicine helps reduce medical expenses. As with the video conference-based users, all of the mobile phone-based users expressed their agreement, but they are more divided between those who strongly agree (52.2%) and those who somewhat agree (47.8%). None of both types of users expressed any neutral and negative responses to the statement that telemedicine reduces medical expenses.

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

Table 3
Distribution of replies by mobile phone and video conference-based telemedicine users that telemedicine helps reduce medical expenses.

Telemedicine helps to reduce medical expenses	Video conference-based		Mobile phone-based	
	f	%	*f*	%
Strongly disagree	0	0.0	0	0.0
Somewhat disagree	0	0.0	0	0.0
Neither agree nor disagree	0	0.0	0	0.0
Somewhat agree	6	12.5	22	47.8
Strongly agree	42	87.5	24	52.2
Total	48	100	46	100

The survey results indicate that telemedicine is believed by the respondents to reduce overall treatment cost which is a crucial benefit for women and girls as they face greater difficulties in arranging expenses for their care. Financial related difficulties were the main theme that emerged from the qualitative data as it was reported by all of the 16 in-depth interviewees. Regarding women's and girls' financial difficulties, a 31-year-old mobile phone-based respondent said:

> "Men can arrange the needed expenses in less time through their friends [using men's network] as they have better access to sources of income or credit, but it takes time for us to arrange the money."

In the past, they were unable to estimate medical and travel expenses before leaving their villages. A 43-year-old video conference-based respondent remembered:

> "A big chunk of money was required for all the treatment process, sometimes, we were even afraid of thinking about that amount. We were not sure, how long we had to stay away from home and how much expenses it would require. It was much more difficult for women compared to men because of lower access to income sources."

Based on focus group discussions with video conferences-based telemedicine users, we found that respondents have been able to better manage healthcare expenses after telemedicine services were introduced. Notably, two themes have emerged. First, many illnesses can now be treated entirely through telemedicine, which substantially reduces travel expenses, as a 42-year-old local facilitator said:

> "After video conference-based telemedicine was introduced, many illnesses have been treated over telemedicine. Doctors examine the illnesses remotely; I help them to update patient's vital signs remotely. Based on these practices, many of the illnesses, even the illnesses beyond my medical capabilities, were also treated over telemedicine."

Similarly, mobile phone-based telemedicine users receive lifeline advice and consultation from their places of residence or sometimes from the local pharmacy nearby, reducing their travel to the district or city-based hospitals. An 18-year-old mobile phone-based telemedicine respondent noted:

> "After mobile phone-based telemedicine services, I can obtain much-needed advice from a doctor over mobile phone which does not require travel to a local pharmacy. Sometimes, I go to the local pharmacy and consult with a doctor from there, so that a pharmacist can also talk over mobile phone with the doctor and provide me the prescribed medicines. Ultimately, these services have reduced my travel to the district hospital which also has cost implication."

Second, telemedicine facilitates the management of health-oriented travel beforehand. A 43-year-old video conference-based respondent stated:

> "If more specialist and laboratory diagnoses are required, then the doctor suggests for us to travel to the city-based hospital. We are informed in advance about whom, where and what regarding our test and treatment, which reduces unnecessary troubles associated with inquiry and test upon reaching the city-based hospital."

Patients can therefore better plan their visits to the hospital, and have a more accurate estimate of related costs.

4.5. Role of telemedicine on sexual and reproductive health consultation

Although it has improved in recent years, evidence shows that sexual and reproductive health related issues are a problem among adolescents and youth in Nepal (Khatiwada et al., 2013). A study has shown that pre-marital sexual activities, early and unwanted pregnancies, abortion, and domestic violence against women are increasing in Nepal (Pathak and Pokharel, 2012). Similarly, another study found that socio-cultural norms have been discouraging young people from using sexual and reproductive healthcare services from rural healthcare centres in Nepal (Regmi et al., 2010). In light of these pressing sexual and reproductive health issues in Nepal, it is important to note that in the current period, our study respondents felt more comfortable to seek consultation through telemedicine regarding sexual and reproductive health matters than in the past when telemedicine was not available. Almost all (97.8%) of the mobile phone-based telemedicine users strongly agreed that telemedicine made it easier to ask about sexual and reproductive health issues, while 81.3% of video conference-based telemedicine users were almost equally divided between strongly agree (39.6%) and somewhat agree (41.7%) (Fig. 2).

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

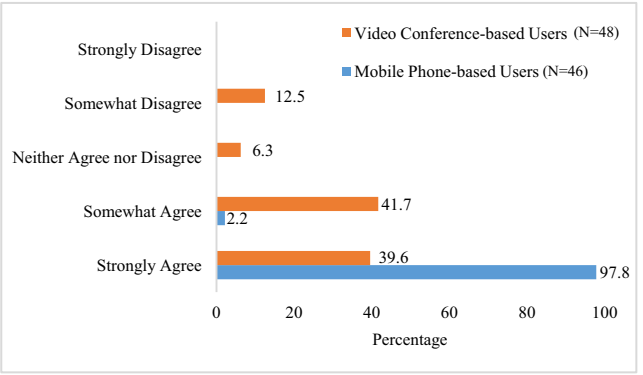

Fig. 2. Distribution of replies by mobile phone and video conference-based telemedicine users that telemedicine made it easier to consult regarding sexual and reproductive issues than in the past.

Interviews also suggest that mobile phone-based telemedicine users tended to ask substantially more questions on sexual and reproductive health problems compared to video conference-based telemedicine users. Queries over mobile phone-based telemedicine were more private in nature and involved issues such as teenage pregnancy, unprotected sex, menstruation, and family planning.

Telemedicine users preferred to ask about sexual and reproductive health problems over mobile phone-based telemedicine even if they had a sub-health post nearby. An 18-year-old mobile phone-based respondent stated:

> "A sub-health post is not that far from my home, but I feel timid to consult regarding sexual and reproductive health problems if travelling there in person, and in a face to face settings, which is not true of mobile phone."

Due to social and cultural norms, women and girls are apprehensive about sharing their sexual and reproductive health problems in face to face visits with a doctor, even with a same-sex doctor, as an another 24-year-old woman said:

> "I lack courage to share my problems sitting opposite to a doctor even if she is female."

It is also difficult to discuss sexual and reproductive health-related problems with family members as a 16-year-old girl who dropped from school to take care of her younger brothers and sisters stated:

> "I had period-related problems. My stepmother is not cooperative with me; thus usually, I ask father when facing any kind of difficulties. But I did not feel comfortable to share my problems with him and suffered in silence until I heard about the mobile phone-based telemedicine."

The availability of telemedicine services has ensured better privacy and anonymity with regards to sexual and reproductive health problems. A visually impaired 17-year-old female mobile phone-based telemedicine user shared the following:

> "I called a doctor twice over the mobile phone, first time I had a chance to talk to a female doctor, but in my second attempt, my phone call was picked up by a male voice. Though he was a male doctor, I felt less discomfort to discuss a genital related health issue with him. I think I got this level of courage due to the telemedicine as it ensures better anonymity so that a doctor can't see us or does not know us personally."

This is also reflected in the following reply from a 32-year-old male doctor who helped at a mobile phone-based telemedicine provider site:

> "We are receiving many calls regarding sexual and reproductive health problems. Though the male callers are still the majority, we are receiving quite a good number of sexual and reproductive health-related calls from women and girls. They ask questions more easily over mobile phone, which is not the case during in-person visits."

Despite the aforementioned benefits, some women and girls shared that not owning a mobile phone and being illiterate can also be constraints in receiving mobile phone-based telemedicine services. The survey indicates that 10% of women and girls did not have a mobile phone thus they had to borrow one from others (villagers) to make a call. For instance, a 30-year-old mobile phone-based telemedicine respondent said:

> "From my experience a mobile phone is a means to connect to a remote doctor. I don't have a mobile phone, thus I have to request others to use their phone which is not always easy to find when needed."

Similarly, illiteracy is also preventing women from calling a doctor as a 45-year-old mobile phone-based respondents said:

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

"I have a mobile phone which was given by my son, who works in Kathmandu [capital city]. I use the mobile phone to receive calls from him, other relatives and friends. I cannot read numbers thus I am unable to make a phone call [. . .]. I have to request others when making a call to the doctor which is difficult to manage, particularly during night times."

Although telemedicine has many benefits in improving access to health services, this shows that a gender approach to telemedicine should also address the issues of ownership and literacy, which are crucial areas of inequality in Nepal.

5. Discussion

This study assessed the role of telemedicine on women's and girls' gender-based barriers to access healthcare services in rural Nepal. Our results showed that rural telemedicine services tend to address several gender-based barriers women and girls face in accessing healthcare services.

First, results have shown that telemedicine can reduce the amount of travel to district or city-based hospitals and consequently, gender-related travel restrictions are less a problem in terms of getting healthcare. Telemedicine services are accessible nearby and, in the case of mobile-phone telemedicine, quickly from anywhere. This has also reduced the need for a travel companion for women and girls, making access to healthcare less dependent on the availability of others. This impact of telemedicine on gender-based travel restriction was also found in studies of rural Pakistan (Khan, 1999; Mumtaz and Salway, 2005). Similarly, this research confirms findings from earlier studies which had shown that telemedicine reduces tedious travel for rural people (Ecken et al., 1997; Ivatury et al., 2009)

Second, women and girls felt fewer constraints in managing time out of their household chores for healthcare after the introduction of telemedicine services. This is important as a study showed that due to household chores women in developing countries experienced hurdles in finding time to reach healthcare centres (Chiang et al., 2013). Similarly, in our study, women and girls could not travel long hours and leave their daily chores unfinished, even if it was for a health-related purpose. Healthcare is now accessible using mobile phones or through a nearby telemedicine centre; thus less time is required for consultation and treatment. Telemedicine services therefore lower the probability that household chores will impede access to healthcare.

Third, many interviews suggest that telemedicine reduces overall expenses by allowing treatment directly in the villages or referring patients to hospitals as prescribed by a remote doctor. In spite of some gender-based financial constraints, telemedicine reduced travel expenses and supported women and girls to seek healthcare when required. That telemedicine reduces travel expenses is also a finding noted by Ivatury et al. (2009). Having no or low income is an important demand-side barrier for women and girls to access healthcare services (Chiang et al., 2013; Ensor and Cooper, 2004; Ojanuga and Gilbert, 1992), therefore telemedicine's decreased costs related to travel and care have a welcome gender effect in this regard.

Lastly, our results also revealed that telemedicine, especially mobile phone-based telemedicine, has encouraged women and girls to ask about sexual health-related information to a doctor that is located remotely with more ease. Though strict gender norms affect access to sexual and reproductive health services, telemedicine made sexual and reproductive health services to some extent more convenient. Women and girls reported that their fear or timidity has reduced considerably because of anonymity ensured by mobile phone-based telemedicine. Our study also supports findings from other studies that mobile phones offer more privacy with regards to sexual and reproductive health queries (Bali and Singh, 2007; Lim et al., 2008).

Although telemedicine tends to reduce gender-based barriers for women and girls, we should take note that their capacity to benefit from telemedicine is constrained in two ways. First, women and girls who do not own a mobile phone (more likely than men) have expressed difficulties in calling a remote doctor. Feminist technology studies have long shown that gender norms can undermine access to technology platforms, and hence access for the same services that men enjoy (Bray, 2007; Wajcman, 2009). Second, women who were illiterate had to request assistance to access mobile phone-based telemedicine. While women and girls' illiteracy rate is decreasing in Nepal, it is still high among older people, especially rural women, and the gap between women and men remains important overall (United Nations, 2015).

We have tried to look into the gender-related aspects of telemedicine. There are limitations to be acknowledged including the followings. One is that the respondents consisted of rural women; therefore, findings on telemedicine and its gender dimensions may not be generalised to an urban context. Another one is that due to the geographically dispersed sample, we could not conduct focus group discussions and observations with mobile phone-based telemedicine users which could have provided more insights into community dynamics.

6. Conclusion

Although a large body of literature revealed the influence of gender-based barriers in accessing healthcare services (Afifi, 2007; Ensor and Cooper, 2004; Khan, 1999), little is known about the role of telemedicine in addressing gender-based barriers over access to healthcare services. Our study has found that telemedicine tends to reduce women's and girls' gender-based barriers in accessing healthcare services in rural areas. By shrinking distance to healthcare services, telemedicine reduces travel, making it easier to manage time out from household chores, reduces treatment expenses, and reduces apprehension female patients may have sharing their sexual and reproductive health problems. This should help us better

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

understand the gender dynamics of ICTs in healthcare, but also shows the interrelation between gender, technology and health. Even though telemedicine and its proponents do not explicitly address gender inequalities, the technology can increase women and girls' access to healthcare services. And with an explicit gender approach that addresses the issues of income, restrictions and literacy, the potential for these impacts to be positive is even greater. We end by calling relevant ministries and telemedicine providers to implement telemedicine programs on a larger scale that tackle unequal access to healthcare services by women and men in rural areas. Similarly, we suggest conducting further research on the gender impacts of using and accessing telemedicine technology and services to further improve access to healthcare. We also recommend to look at the cost implications of healthcare services between telemedicine users and non-users.

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgement

The authors would like to thank the editor and anonymous reviewers for helpful comments.

References

Afifi, M., 2007. Gender differences in mental health. Singapore Med. J. 48, 385–391.
Angood, P.B., Satava, R., Doarn, C., Merrell, R., 2000. Telemedicine at the top of the world: the 1998 and 1999 Everest extreme expeditions. Telemed. J. e-Health 6, 315–325.
Avotri, J.Y., Walters, V., 1999. "You just look at our work and see if you have any freedom on earth": Ghanaian women's accounts of their work and their health. Soc. Sci. Med. 48, 1123–1133.
Balarajan, Y., Selvaraj, S., Subramanian, S.V., 2011. Health care and equity in India. Lancet 377, 505–515.
Bali, S., Singh, A.J., 2007. Mobile phone consultation for community health care in rural north India. J. Telemed. Telecare 13, 421–424.
Baral, J.C., 1986. Nepal: its land and its uses. In: Last, F.T. et al. (Eds.), Land and Its Uses—Actual and Potential. Plenum Press, New York, pp. 523–534.
Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3, 77–101.
Braveman, P., Egerter, S., Williams, D.R., 2011. The social determinants of health: coming of age. Annu. Rev. Public Health 32, 381–398.
Bray, F., 2007. Gender and technology. Annu. Rev. Anthropol. 36, 37–53.
Buor, D., 2004. Gender and the utilisation of health services in the Ashanti Region, Ghana. Health Policy 69, 375–388.
Chiang, C., Labeeb, S.A., Higuchi, M., Mohamed, A.G., Aoyama, A., 2013. Barriers to the use of basic health services among women in rural southern Egypt. Nagoya J. Med. Sci. 75, 225–231.
Creswell, J.W., Plano Clark, V.L., Gutmann, M.L., Hanson, W.E., 2003. Advanced Mixed Methods Research Designs. Sage, New Delhi.
Dalfra, M.G., Nicolucci, A., Lapolla, A., 2009. The effect of telemedicine on outcome and quality of life in pregnant women with diabetes. J. Telemed. Telecare 15, 238–242.
Ecken, B.K., Harbick, R.F., Pease, A.L., 1997. Uses and benefits of telemedicine. Minim. Invasive Ther. Allied Technol. 6, 444–447.
Ensor, T., Cooper, S., 2004. Overcoming barriers to health service access: influencing the demand side. Health Policy Plan. 19, 69–79. 8, 17–19.
Faulkner, W., 2001. The technology question in feminism: a view from feminist technology studies. Womens Stud. Int. Forum 24, 79–95.
Feinstein, L., Sabates, R., Anderson, T.M., Sorhaindo, A., Hammond, C., 2006. What are the effects of education on health. In: Proceedings of the Copenhagen Symposium on Measuring the Effects of Education on Health and Civic Engagement, Denmark, 2006.
Ganapathy, K., Chawdhry, V., Premanand, S., Sarma, A., Chandralekha, J., Kumar, K.Y., Kumar, S., Guleri, R., 2016. Telemedicine in the Himalayas: operational challenges—a preliminary report. Telemed. e-Health 22, 821–835.
Grint, K., Gill, R., 1995. The Gender-Technology Relation: Contemporary Theory and Research. Taylor & Francis.
Ivatury, G., Moore, J., Bloch, A., 2009. A doctor in your pocket: health hotlines in developing countries. Innovations 4, 119–153.
Kathmandu University, 2015. Telemedicine Services in Nepal Retrieved from: http://www.sasecrtn.edu.np/index.php/en/resources/usefulinfo/information-on-e-health-and-telemedicine/telemedicine-services-in-nepal.
Khan, A., 1999. Mobility of women and access to health and family planning services in Pakistan. Reprod. Health Matters 7, 39–48.
Khatiwada, N., Silwal, P.R., Bhadra, R., Tamang, T.M., 2013. Sexual and Reproductive Health of Adolescents and Youth in Nepal: Trends and Determinants. Nepal Ministry of Health and Population, Kathmandu.
Kifle, M., Mbarika, V.W.A., Datta, P., 2006. Telemedicine in sub-Saharan Africa: the case of teleophthalmology and eye care in Ethiopia. J. Am. Soc. Inf. Sci. Technol. 57, 1383–1393.
Lim, M.S.C., Hocking, J.S., Hellard, M.E., Aitken, C.K., 2008. SMS STI: a review of the uses of mobile phone text messaging in sexual health. Int. J. STD AIDS 19, 287–290.
Magann, E.F., McKelvey, S.S., Hitt, W.C., Smith, M.V., Azam, G.A., Lowery, C.L., 2011. The use of telemedicine in obstetrics: a review of the literature. Obstet. Gynecol. Surv. 66, 170–178.
Marmot, M., Friel, S., Bell, R., Houweling, T.A.J., Taylor, S., 2008. Closing the gap in a generation: health equity through action on the social determinants of health. Lancet 372, 1661–1669.
McIntyre, D.I., Thiede, M., Birch, S., 2009. Access as a policy-relevant concept in low-and middle-income countries. Heal. Econ. Policy Law 4, 179–193.
Men, C.R., Frieson, K., Socheat, C., Nirmita, H., Mony, C., 2011. Gender as a social determinant of health: gender analysis of the health sector in Cambodia. In World Conference on Social Determinants of Health, Rio De Janeiro.
Millman, M., 1993. Access to Health Care in America. National Academy of Sciences, Washington, D.C..
Moffatt, J.J., Eley, D.S., 2011. Barriers to the up-take of telemedicine in Australia-a view from providers. Rural Remote Health J. 11, 1–6.
Moffatt, J.J., Eley, D.S., 2010. The reported benefits of telehealth for rural Australians. Aust. Health Rev. 34, 276–281.
Mumtaz, Z., Salway, S., 2005. "I never go anywhere": extricating the links between women's mobility and uptake of reproductive health services in Pakistan. Soc. Sci. Med. 60, 1751–1765.
Nepal Mountain News, 2011. Telemedicine Service Winning Heart of Villagers Retrieved from: http://www.nepalmountainnews.com/cms/archives/20572.
Norris, A.C., 2002. Essentials of Telemedicine and Telecare. Wiley, West Sussex, England.
Ojanuga, D.N., Gilbert, C., 1992. Women's access to health care in developing countries. Soc. Sci. Med. 35, 613–617.
Pandey, T., 2012. "Online" Clinic Saving Lives in Kalikot. Retrieved from: http://kathmandupost.ekantipur.com/printedition/news/2012-01-12/online-clinic-saving-lives-in-kalikot.html.
Pathak, R.S., Pokharel, T., 2012. Sexual & reproductive health status of adolescents & youth in Nepal. Nepal Popul. J. 17, 131–141.
Penchansky, R., Thomas, J.W., 1981. The concept of access: definition and relationship to consumer satisfaction. Med. Care 19, 127–140.

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006

Piya, R., 2010. Scope and Challenges of Telemedicine in Nepal: a Look Towards Future. University of Tromsø.
Rai, S., 2013. Telemedicine to Support Health Care Delivery in Nepal: a Case Study in Kathmandu Model Hospital. University of Tromsø.
Regmi, P.R., Van Teijlingen, E., Simkhada, P., Acharya, D.R., 2010. Barriers to sexual health services for young people in Nepal. J. Health Popul. Nutr., 619–627
Sen, G., Ostlin, P., 2008. Gender inequity in health: why it exists and how we can change it. Glob. Public Health 3, 1–12.
Solberg, S., Church, J., Curran, V., 2003. Experiences of rural women with breast cancer receiving social support via audioconferencing. J. Telemed. Telecare 9, 282–287.
Subedi, R.R., Peterson, C.B., Kyriazakos, S., 2011. Telemedicine for rural and underserved communities of Nepal. In: 15th Nordic-Baltic Conference on Biomedical Engineering and Medical Physics. Springer, Aalborg, Denmark, pp. 117–120.
United Nations, 2015. The World's Women 2015: Trends and Statistics. Department of Economic and Social Affairs, Statistics Division, New York.
Wajcman, J., 2009. Feminist theories of technology. Cambridge J. Econ. 34, 143–152.
Wang, F., Luo, W., 2005. Assessing spatial and nonspatial factors for healthcare access: towards an integrated approach to defining health professional shortage areas. Health Place 11, 131–146.
World Health Organization, 2010. Gender, Women and Primary Health Care Renewal: A Discussion Paper. WHO Press, Geneva.
Yamane, T., 1967. Statistics: An Introductory Analysis. Harper Row, New York.

Please cite this article in press as: Parajuli, R., Doneys, P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. Telemat. Informat. (2017), http://dx.doi.org/10.1016/j.tele.2017.05.006