

# Maternal health-related barriers and the potentials of mobile health technologies: Qualitative findings from a pilot randomized controlled trial in rural Southwestern Uganda

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## ABSTRACT

**Background:** Maternal mortality rate remains unacceptably high in Uganda. In-depth evidence about the barriers to access and utilization of maternal health services specifically among the rural illiterate pregnant women remains lacking. The potentials of mobile health technologies in addressing the maternal health challenges remain unclear. **Aim:** To explore the maternal health-related barriers among illiterate pregnant women in rural Southwestern Uganda and highlight the potentials of mobile health technologies. **Material and Methods:** This is a midline qualitative study conducted with the participants of a pilot randomized controlled trial. Between October 2019 and December 2019, we carried out semi-structured interviews with 30 illiterate pregnant mothers. Interviews elicited information on the barriers to access and utilization of maternal health services. An inductive, content analytic approach was used to analyze qualitative data. Quantitative sociodemographic and socioeconomic data were summarized descriptively. **Results:** Participants reported that lack of money (for transport and medical costs), unfriendly maternal health services, and delays at the maternal health clinic constrain access and utilization of maternal health services. Given their widespread adoption, mobile technologies can potentially address some of these barriers e.g., money for transport or microenterprise start-up can be sent to women through their mobile phones or maternal health-related services (such as health education and consultation) can be provided electronically. **Conclusion:** Future efforts should focus on utilizing mobile health technologies to not only enable women overcome the critical financial challenges but also facilitate remote access and utilization of maternal health services.

**Keywords:** Barriers, illiterate pregnant women, maternal health access, mobile health technologies, service utilization

## Introduction

Maternal and child mortality rate still remain alarmingly high in low resource settings especially in sub-Saharan Africa. In 2017, of the 295,000 maternal deaths that occurred globally, 254,000

occurred in sub-Saharan Africa and South Asian countries alone, with sub-Saharan Africa alone accounting for an estimate of 66% and Southern Asia 20%.<sup>[1]</sup> This report indicates that the rate of maternal mortality in Uganda currently stands at 375 per 100,000 live births—which makes the country among the world's high maternal mortality rate countries. Majority of these deaths occur among the illiterate and poor women due to the lack of access to reliable information and quality maternal health services.

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Ensuring the health and wellbeing of the pregnant mothers and their unborn babies is a global priority and a key component for the Sustainable Development Goal (SDG) number 3— “Ensure healthy lives and promote wellbeing at all ages”.<sup>[2]</sup> Taking good care of pregnant women not only increases their survival rates but also results into giving birth to healthy babies, thus ensuring the health of families and communities. The SDGs advocate for reducing the global maternal mortality rates to less than 70 per 100,000 live births by 2030.<sup>[1]</sup> However, the achievement of this target seems impossible in Uganda mainly due to predominantly lack of access to maternal health services especially among the illiterate pregnant women from rural poor communities.

The benefits of attending antenatal care include improved health of the mother and child, planned birth and emergence preparedness, as well as identification and management of obstetric complications and infections.<sup>[3]</sup> Facility-based delivery results in timely management of maternal complications, and enables preventing mothers and new-borns from infections. The proportion of pregnant women attending antenatal care and delivering from healthcare facilities with support from skilled personnel in Uganda is still low. Only 58% of the pregnant mothers attend at least four recommended visits, and 57% women deliver from healthcare facilities in Uganda.<sup>[4]</sup> Women from rural communities are twice less likely to attend antenatal care compared to their counterparts in urban settings.<sup>[5]</sup> Attending antenatal care services is more pronounced among the literates compared to the illiterates in Uganda.<sup>[6]</sup> Women with no education are 2.7 times at a risk of maternal mortality compared to their counterparts who were educated.<sup>[7]</sup> Previous studies have documented some barriers to the utilization of maternal health services such as long distances to the health facilities and lack of supplies and drugs.<sup>[8,9]</sup> These studies generally focused on pregnant women irrespective of their level of education. The barriers to access and utilization of maternal health services specifically among rural illiterate pregnant women remain unclear. In addition, the potentials of mobile phone-based interventions in addressing maternal health-related barriers particularly among illiterate women remain unknown. In this study, we explored the barriers that constrain the access and utilization of maternal healthcare among the illiterate pregnant women in rural Southwestern Uganda. We also discuss the potentials of using mobile technologies to address the maternal health-related challenges.

## Material and Methods

### Study design and setting

The study utilizes semi-structured interviews in a qualitative method study design. Participants (pregnant mothers) were recruited from the department of obstetrics and gynaecology, Mbarara Regional Referral Hospital (MRRH), which is the largest hospital in rural Southwestern Uganda. The MRRH employs 11 obstetricians and 22 midwives and performs over 10,000 deliveries annually with a maternal mortality rate of 270/100,000 live birth and cesarean section rate of 30% and a perinatal

mortality rate of 56/1000. Sociodemographic and basic health data are captured from pregnant women during their first visit and stored in paper-based antenatal registers. Each woman is given an antenatal card that contains her biodata as well as the date of the next appointment. Women are expected to attend at least four antenatal appointments and they are supposed to bring their antenatal cards on every visit. The clinic verbally provides group-based health talks to women. The talks are scheduled according the trimesters—first trimester talks are offered on Tuesdays, second trimester talks on Wednesdays, and third trimester health talks on Thursdays. The topics covered in these talks include nutrition and birth preparedness. There are currently no follow-up mechanisms for pregnant women who miss attending their antenatal appointments.

### Selection of study participants

Between Jan 2019 and Dec 2019, we purposively selected 80 pregnant women receiving antenatal care from the department of obstetrics and gynaecology, Mbarara Regional Referral Hospital. Inclusion criteria were as follows: a) initiating antenatal care at MRRH at the earliest presentation in the first and second trimester, b) being illiterate (not having studied beyond primary seven or elementary education), c) 18 years and above, d) residents of Mbarara (within 20 km of MRRH), e) ability to use mobile phones, and f) willing and able to give informed consent.

### Study procedures

These were women who were part of the study that was using a mobile phone-based multimedia application to support maternal health. The application was developed using Java programming language, while the database that hosts multimedia messages was developed using SQLite. It is an offline (stand-alone) application which does not run on the internet. It was developed following user-centred design approaches that involved incorporating input from pregnant women as prospective users. The application was installed on affordable smartphones provided by the study. Pregnant women were provided with solar chargers to supplement electricity charging. The application has three major functionalities;

- a. The video/audio function; which provides locally customized videos and audios that provide personalized maternal health information to pregnant women based on their pregnancy stages. Contents of the videos/audio messages include nutrition, breast feeding, HIV testing, spouse involvement, family planning, danger signs, preparing for child birth, care during pregnancy, care during delivery and postnatal care.
- b. The appointment reminder function allows the users to set the dates and reminders for their next antenatal care appointment.
- c. The calling function through which the pregnant women can communicate with health workers and ask pregnancy-related queries or application related issues.

It also has login module which uses pictorial password to allow access to the application.

## Data collection

From private space at a research office near the MRRH, WT and JK carried out semi-structured interviews with illiterate pregnant mothers between August 2019 to October 2019. Interviews were carried out until thematic saturation was achieved (i.e., until no new data was obtained) — which occurred after the 30<sup>th</sup> participant. Each interview lasted between 40 and 50 minutes. All questions in the interview guide for women were translated into the local language (Runyankole) and back-translated to English by a different translator, after which the two versions were compared for accuracy. The interviews with pregnant women were carried out in Runyankole (local language), digitally recorded, transcribed, and translated to English. Interviews mainly elicited information about participants' understanding of the barriers that constrain them from accessing maternal health services. Following each interview, WT, AM, GM, and ECA reviewed the transcripts for quality, clarity, and detail. WT also administered surveys to pregnant women to collect information of their sociodemographic and socioeconomic status.

## Analysis

Inductive content analysis<sup>[10]</sup> was used to derive categories describing and summarizing the participant's barriers to accessing maternal health services. Initially, AM and WT reviewed and discussed 20% of transcripts for content relevant to participants' barriers constraining the participant's access to maternal health services. Then the codebook was assembled by AM and WT from the identified concepts, using an iterative process, which included developing codes to represent content, writing operational definitions, and selecting illustrative quotes. NP and ECA also reviewed and discussed the codebook. Following the completion of the codebook, AM and WT applied codes using NVIVO 11. Differences in coding were harmonized through discussion. TW and AM used STATA 13 to describe study participants' characteristics as indicated in Table 1 and social economic status in Table 2.

## Human subjects and ethics approval

This study was approved by the Institutional Review Committee of Mbarara University of Science and Technology (No: 30/04-18), and the Uganda National Council for Science and Technology (no: SS 4661). All participants provided signed informed consent before study participation.

## Results

As indicated in Table 2 above, 31 (86.1%) had running water at home, while 33 (91.7%) had no regular income.

## Interview results

The following section documents barriers reported by pregnant women in relation to accessing and utilization of maternal health care in rural south western Uganda. The identified barriers were grouped into three themes: 1) lack of money for transport, and

**Table 1: Socio-demographic and basic health status characteristics of study participants**

Characteristic	Pregnant women (n=80 (%))
Median age (years) include IQR	25 (IQR=10)
Marital status	Married (70, 87.5%)
Education	
Lower primary up to P3*	11 (13.8%)
Upper primary (P4 to P7)*	65 (81.3%)
No education	4 (5%)
Reading	
Able to read English	21 (26.9%)
Able to read Runyankole	74 (94.9%)
Living with HIV	9 (11.3%)
Mean (SD) months of pregnancy	3.4(1.1)
Mean (SD) months of follow-up	6.1(6.0)
No regular income	65 (81.3%)
Household food not enough	60 (75%)

\*In the Ugandan education system, P3 is often attended by 6 to 8 year olds. P4 to P7 is often attended by 9 to 12 year olds.

**Table 2: Social economic status of the intervention participants**

Social economic details	Pregnant women (n=36)
No running water at home	31 (86.1%)
Without non-dirt floor	21 (58.3%)
No electricity	14 (38.9%)
Home ownership	28 (77.8%)
Without regular income	33 (91.7%)
Lost to follow	4(10%)

medical costs, 2) unfriendly maternal health services, and 3) delays at maternal health clinics.

## Lack of money for transport and medical costs

The participants reported difficulties in the clinic due to lack of money for transport. Consequently, some participants borrowed money for transport from friends and relatives. Others ended up missing appointments and others did exhausting manual labour to raise the money. While others resorted to walking long distances, which resulted in reaching the clinics late.

*R: I looked for transport to bring me today and I couldn't get it. I found myself in regrets of why I got this pregnancy. I decided to walk up to here, but it was a long distance, so I reached late, and they refused to attend to me. (Pregnant woman, 33 Years).*

*R. I had no money to come to the clinic, so, I borrowed from a friend. (Pregnant woman, 28 years).*

Participants reported lack of money to meet medical costs such as ultrasound scans, as well as items required for delivery.

*R: I went to the hospital and they required me to do a scan which I couldn't do then because I had no money. I had to go back and first look for money...I also did not manage to buy mama kit because I did not have money. (Pregnant woman, 24 Years).*

In order to raise money to meet these necessities, some participants reported spending long hours of work to meet the costs and this has resulted into negative health issues.

*R: I have to spend long hours working in people's gardens to get money to go to the hospital for antenatal visits and at some point I developed pain in my body because of working a lot. (Pregnant woman, 21 years).*

### Lack of friendly maternal health services

Participants reported lack of friendly maternal health services at antenatal clinics. This was manifested in the form of rude communication from healthcare workers or denial of services in case of coming late to the clinic. Consequently, some women missed antenatal care appointments or/and transferred to another clinic.

*R. One day I walked and reached the hospital late, nurses refused to attend to me. I tried explaining to them, but they abused me sometimes. Now days when I see that I will be late, I don't bother coming, because I know I will be chased (Pregnant woman, 31 Years).*

### Delays at the clinic

Some participants highlighted long hours of waiting at the health facility moreover on empty stomachs. This sometimes results in not being attended to especially in instances when the staff on duty are few.

*R: I come for antenatal check-up but they delay to work on us. We wait all day on empty stomachs—they normally work on us in the evening mostly by 6:00pm. One time, I came to the hospital for antenatal check-up but there was only one nurse on duty. She collected our medical forms and got tired before she could work on all of us. So she told us to go back and come on a different day. (Pregnant woman, 25 years).*

## Discussion

Pregnant women reported lacking money to meet the cost of transport to the clinic and to pay medical costs such as ultrasound scans, as well as buying requirements necessary for delivery. Consequently, some women resorted to borrowing money for transport, others walked for long distances and ended up delaying to reach the clinic, while others ended up missing the scheduled appointments. Participants reported unfriendly maternal health services in the form of unkind words from healthcare providers or failing to be attended to when they reach late for their appointments or when they fail coming with particular requirements. This resulted into missing antenatal care (ANC) appointments or/and transferring to another clinic in search for friendly services. Being harsh to illiterate women who have travelled long distances to seek care from a health facility discourages them from attending the antenatal visits, which exposes them to the risks of maternal health complications. Participants reported long waiting hours at the clinic before being attended to. In worst case scenarios, they would not be attended to, even after waiting for a whole day on empty stomachs.

Although attending ANC enables early diagnosis and reduces maternal and infant morbidity and mortality,<sup>[11]</sup> financial difficulties limit access to ANC. The illiterate women were mainly housewives who depend on their poor spouses for provision. Supporting them with microenterprise interventions<sup>[12]</sup> and/or financial incentives such as economic empowerment programs like non-refundable cash could help them meet their pregnancy-related costs.<sup>[13]</sup> Given the widespread adoption of mobile money applications (money delivered via mobile phones) in Uganda, financial incentives can be delivered directly to women's mobile phones, which they can withdraw from any mobile money agent. This approach can be feasible since mobile phone technology is the most growing technology with over 63.2% of women owning phones in Uganda.<sup>[14]</sup> Due to lack of access to formal banking services, more than 23.5 million people have mobile money subscriptions.<sup>[15]</sup> Using mobile money technologies, women can save and receive deposits from their social network for their maternal health on their mobile phones. Alternatively, prearranged transport can be provided using existing community-based mobile transport applications such as Safe Bodas, Uber, and Taxify.<sup>[16]</sup> Mobile-based applications can also be used to help a mother locate the nearest relevant clinic to minimize the problem of long distances.<sup>[17-19]</sup>

Unfriendly maternal health services, e.g., denial of services can result in double spending on transport in case of rescheduled appointment or missed appointments due to the lack of transport to the clinic or denial of permission from the spouse. Disrespectful and rude communication is associated with no use of antenatal services, late initiation of antenatal care, no use of facility-based deliveries, and low participation of men in maternal health.<sup>[9,20-24]</sup> Utilizing mobile health has the potential to relax the existing challenges in Uganda that result in unfriendly services. This can be through providing quick access to information to illiterate women, ensuring adequate and qualitative interaction between the healthcare workers and pregnant woman, which helps in reducing the amount of time spent at the health facilities and issues of being bounced back. For instance, we are currently implementing a randomized control trial (NCT04089800) that utilizes mobile phone-based multimedia application to provide maternal health information, electronic consultations, and antenatal appointment reminders to illiterate women in the same setting. This application can potentially improve interaction between pregnant women and healthcare providers since women can directly call healthcare providers using their mobile phones. The application can also reduce unnecessary delays at the clinic through remote accessibility of maternal health information, thus relieving women from being exhausted by long waiting hours, losing productive times, going above the timelines allowed by their husbands and spending on transport to the clinic. Mobile phone-enabled technologies can also facilitate remote monitoring for danger signs, labour, and pregnancy-related blood pressure.<sup>[25-30]</sup>

The main strength of this study is that it identifies the key insights about barriers limiting the access and utilization of

maternal health services among illiterate rural women in a rural sub-Saharan African setting. It also highlights the potentials of mobile health technologies in addressing maternal health related barriers. The findings have implications for similar settings although cultural differences may differ. However, results may have limited generalizability as they are based on a small pilot study, but the achievement of theme saturation generally suggests the sample was adequate.

## Conclusion

In sum, lack of money for transport and medical costs, unfriendly maternal health services, and delays at maternal health clinics continue to make women lose their lives while giving lives in Uganda. Mobile technologies can potentially address some of these barriers, e.g., by delivering financial incentives through mobile money technologies and enabling remote access of maternal health services. Physicians in primary care facilities need to always bear in mind that the utilization of current mobile health technologies for the provision of maternal health-related services not only improves the quality of care among pregnant women but also enhances the delivery of healthy babies. The integration and incorporation of mobile health technologies in the primary care system has the potential to ensure universal access to maternal health-related information. More research is needed to assess the utilization of mobile health technologies to support maternal and child health especially in low resource settings.

## Trial registry

The study was registered with ClinicalTrials.gov (NCT04089800).

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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