Adoption of Mobile Phone Messages for Delivery and Newborn Care in Bangladesh

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Abstract

In Bangladesh, mobile phones have been adopted as a health communication tool to improve maternal and child healthcare. To understand what works and what doesn't work for mobile phone based messages around delivery, postpartum and newborn care in resource limited settings we interviewed 33 women who enrolled in an educational service that provides twice weekly voice or text messages to pregnant women and mothers of 0-11 month old babies and had participated in a survey. This follow up qualitative exploratory study showed that women appreciated receiving messages around newborn care and nutrition information over pregnancy messages. Women in low- income households faced challenges accessing messages on shared phones while those with low literacy and limited technological knowledge preferred to receive voice messages over text messages. Husband's endorsement of the service improved women's adoption of the messages. Knowledge on additional consultation service and information on how to enroll in the service for later pregnancies was found to be low. Some participants were reluctant to pay for educational messages and avoided the calls. Women's healthcare practices suggested growing awareness on biomedical practices although women from low- income households were more likely to follow traditional unskilled birthing and newborn care practices at cultural influences unless experienced complications. Besides providing contextual messages, a holistic response is required that includes; training local birth attendants, sensitizing female family members who organize the home based deliveries, and establishing a subsidized referral system to improve birth related health outcomes in low- income households.

Keywords: mHealth, delivery, newborn care, Bangladesh

1. Background

Low-income countries account for almost all maternal and neonatal deaths in the world from causes that are preventable by simple, cost-effective interventions (WHO, 2018). Preventive measures include regular antenatal check-ups, recognition of dangerous symptoms and timely interventions, such as delivery with skilled birth attendant or at health facility, essential newborn care and postnatal check-ups from medically trained providers (WHO, 2017). A mobile phone based health service (mHealth) has potential to respond to the unequal distribution of the health workforce in urban and rural areas and inequity in access to Maternal, Neonatal and Child Healthcare services (MNCH) in low income countries (Colaci, Chaudhri, & Vasan, 2016; Langlois et al., 2015; Speciale & Freytsis, 2013). As in many other countries, Bangladesh, the most densely populated country in the world, has adopted mHealth services in the national policy to strengthen the health system, especially for MNCH (MOHFW, 2018). Although Bangladesh's achievement in reducing under-5 child mortality has been remarkable, the decline in neonatal mortality rate (NMR) and infant mortality rate (IMR) has slowed recently; NMR was reported as 28 per 1,000 live births while IMR as 38 per 1,000 live births in 2014 (National Institute of Population Research and Training, 2017). Similarly Maternal Mortality Ratio (MMR) has stalled at 196 per 100,000 live births in 2016 after declining at a rate of 40% between 2001 and 2010 (National Institute of Population Research and Training, 2017).

Mobile phone subscriptions have sky rocketed in Bangladesh; in 2012 total subscribers increased from 86.5 to 97.1 million in a year amongst a population of almost 150 million people (BTRC, 2012). There is a reliable platform for mHealth interventions and increasing mobile phone ownership among women (Khatun, Heywood, Ray, Bhuiya, & Liaw, 2016; Tran et al., 2015). However, there is little evidence on the effectiveness of mobile phone based educational services on delivery, and pre-and postnatal care in Bangladesh. Over the last two decades numerous mobile phone based interventions in Bangladesh did not extend beyond the pilot phase (Ahmed et al., 2014).

The "Aponjon" service, deployed in 2012, is an example of a global public-private initiative endorsed by the Government of Bangladesh that provides national and internationally endorsed guidelines on best practices around pregnancy, delivery and postpartum care. Culturally appropriate messages designed by national and international experts, are disseminated to pregnant women and mothers of 0-11 months old babies (Alam, D'Este, Banwell, & Lokuge, 2017; Rajan et al., 2013). The effectiveness of Aponjon messages in influencing behavioral outcomes has been measured (Alam et al., 2017; Chowdhury, Shiblee, & Jones, 2019). A survey conducted in 2014 on 476 subscriber women showed no or limited effect on delivery and postpartum healthcare practices such as delivery by a skilled birth attendant, initiation of breastfeeding right after birth, delay of bathing of newborn baby and completion of recommended postnatal check-ups (Alam et al., 2017). Factors such as women's higher education and wealth, older age and lower parity were associated with an increase in birthing at health facilities (Alam et al., 2017).

However, little is known about what prevented some women from following the recommended practices delivered through Aponjon's mobile phone messages, especially in low income households.

In order to better understand the adoption of mobile phone messages around maternity, newborn and infant care, a sub-sample of respondents from the aforementioned survey were recruited for in-depth interviews (Alam et al., 2017). This exploratory study aimed at understanding women's perception of message content, barriers to adopt messages and socio-cultural context of women's birthing and childcare practices. Our study provides further in-depth evidence on the adoption of mHealth services, their relationship to MNCH behavioral change in Bangladesh and, more broadly, on the usefulness of mHealth in similar resource-poor settings where the rapid uptake of mobile phone based education interventions is yet to be fully assessed.

2. Methods

2.1 Intervention

Any woman with access to a personal or shared phone is eligible to enroll in the service during any stage of pregnancy or after childbirth. They are enrolled by community health workers, Non-Government Organization (NGO) clinics or service call center (Rajan et al., 2013). Subscriber women receive two messages (voice or text) per week with an optional additional message for their husband or other family members, appropriate to their gestational stage (Rajan et al., 2013). After childbirth pregnant women are upgraded to a "newborn service" by call center agents on confirmation of delivery. The service terminates when the infant reaches his/her first birthday, however, any subscriber can opt out earlier (Alam et al., 2017). There is an additional hotline service where subscribers can consult with medically trained doctors on maternal and newborn health issues at a regular call rate (Alam, Banwell, Olsen, & Lokuge, 2019). The voice messages are in Bangla and are one minute long while each text message typically contains 161 characters in transliterated Bangla format to support a full range of mobile phones (Alam et al., 2017). A subscriber can retrieve missed messages (voice) by dialing the service and following an automated voice-prompted menu. The messaging service is free for low income households and costs USD 0.02 (BDT 2.3) for others (Alam et al., 2017).

Table 1. Sample messages

Sample voice message (Pregnancy)	Sample text message (New born baby)
You are now on the 37th week of your pregnancy. I am your Doctor Apa speaking. Your baby is getting ready for birth. You'll experience labour pain soon. Keep contact with your health care provider. Contact your doctor if you observe any danger signs. Another important information; you'll need to see your health care provider within 24 hours of childbirth for the first visit, then on the third day of delivery for second visit, on seventh day of delivery for the third visit and on 42nd week after delivery for the fourth visit. These visits are important for you and your baby. Are you experiencing water break? I will talk more on delivery symptoms next week.	If you are a working mother, probably you are getting ready to get back to work. You can store breast-milk in a cup before you leave for work. The milk will be okay for the next 8 hours. In your absence, someone can feed the baby breast-milk with a spoon. Remember to inform the caregiver about the feeding procedure and timetable.

2.2 Study Area

Bangladesh is located at the top of the Bay of Bengal and shares borders with India in its' north, west and east and with Mymanmar in south-west (Ministry of Health and Family Welfare, 2015). The majority of the population is Muslims (89.3%) with the remainder (10.7%) comprised of Hindus, Buddhists, Christians and other religious groups (DGHS, 2012). Administratively the country is divided into 8 large divisions and 64 districts (BBS, 2019). For this study five districts were selected from the northern (Bogra), south-east (Chittagong, Laxmipur) and southern (Bagerhat and Patuakhali) part of Bangladesh in order to maximise diversity in culture, language and geographical location of participants. All participants in this study were initially recruited to the service by their designated community health workers.

2.3 Interviews

All study participants were subscribers to the "Aponjon" service and had participated in a previous survey in 2014 when their last born child's age was between 3-18 months (Alam et al., 2017). One hundred and ten respondents from the original survey, living in selected study areas were approached. Of these 35 women were able to be re- contacted by phone almost two years after the survey and 33 agreed to be interviewed and two declined.

Approximately 25% of dialed phone numbers were disconnected, and 43% of participants did not answer after two contact attempts. If the phone belonged to a family member who was away from home, an alternative time was arranged to discuss the research with the subscriber woman before taking her consent for the interview. The first author interviewed the 33 women over the phone using either Bangla or a local dialect (for respondents in Chittagong) between December 2015 and January 2016. Interviews, lasting between 15-35 minutes, were recorded with the consent of the participant after an information sheet was read to them. Participants were given their rights to not answer any question and withdraw from the research without any consequences. The study received approval from an International Review Board (IRB) and an IRB exemption from related organizations for conducting the study in Bangladesh.

Information on the participants' socio-economic status such as age, level of education, family expenditure and pregnancy history was collected. Open-ended interview questions were used to explore women's experiences of Aponjon, mobile phones in general, and healthcare seeking behavior for pregnancy, birthing and pre- and postnatal period. Women were asked a range of questions such as: "Can you tell me your experience regarding Aponjon service and messages (who accessed the messages, usefulness of information, barriers to receiving messages)?", "Would you recommend the service to others or re-enroll for next pregnancy, why or why not?", "Can you tell me about your life during pregnancy (check-ups, type of provider, preparedness for delivery, nutrition, vaccination, family custom)?" "Can you tell me about the last birth and previous births (selection of delivery place and birth attendants, complications, people involved in decision making), "Can you tell me what (feed) the baby was given right after birth and the reason behind it?", "Can you tell me when did the baby receive the first bath and who initiated it?", " Can you tell me how you took care of the umbilicus of new born baby and what was the source of your information?", "Did you see anyone for check-up or symptoms within the first 42 days after childbirth? Why or why not?", "Who do you usually contact for your or infant's health?" and "Have your children been immunized?".

Interviews were transcribed verbatim and translated into English by first author. The transcripts were uploaded into Atlas.ti for storage, organization and analysis (Friese, 2012). Thematic analysis was used to identify pertinent and common experiences across participants. This involved repeated readings of transcripts by first author, and coding to develop themes. The analysis was guided in part by the interview questions related to women's experiences of Aponjon, maternal and newborn care practices and socio-cultural contexts in which the service was received. A number of sub-themes were identified inductively and then organized under three key themes (Braun & Clarke, 2006).

Table 2. Themes and sub-themes

Themes	Sub-themes
1. Perceived benefit of the service	1.1 Useful information
	1.2 Involvement of husbands
2. Perceived barrier	2.1 Access to messages
	2.2 Literacy
	2.3 Service knowledge
	2.4 Willingness to pay
3. Healthcare practices and norms	3.1 Traditional practices
	3.2 Biomedical services

3. Results

Background information of the participants is provided in Table-3. Participants were mostly young mothers aged less than 25 years. Participants exemplified a wide range of educational background ranging from having never attended school to completing secondary education or more. Women were mostly housewives, meaning they were reliant on their husbands and other family members for living and decision making on major expenditures. Almost half of the participants came from poor households (monthly income USD 118.15).

Table 3. Background information of participants

Characteristics	Total N=33
Age	
19-24 years	22
25 years or above	11
Education of women	
Never attended school or primary education incomplete	4
Primary education complete	10
Junior secondary complete	8
Secondary education complete or above	11
Occupation of participant women	
Housewife	28
Healthcare provider	3
Teacher	2

Family monthly income (BDT)	
≤10,000 (USD 118.15)	16
10,001-20,000 (USD 118.15-236.30)	9
20,001 (USD 236.30) or above	8
Number of living kids	
1	16
2	13
3 or more	4
Access to Aponjon messages	
Women accessed messages in her phone	20
Women accessed messages in shared phone	13
Voice or text messages	
Voice messages	32
Text messages	1

3.1 Theme-1: Perceived Benefit of the Service

3.1.1 Useful information

Although half of the participants were enrolled in pregnancy, in general participants were more likely to remember information about their newborn baby's nutrition, development, growth and details on caring than their personal health. Automated mobile phone messages according to women's gestational stages helped new mothers to cope with their journey in motherhood while experienced mothers were reminded of the recommended practices. Often participant women shared the messages with elderly female family members who were also involved in taking care of the baby.

"The service is essential for first time mums like me. I was about to join work after the [maternity] break when I received messages from Aponjon about how to gradually introduce solid food to a baby. You know babies begin to take solids around six month of age. But I didn"t know how to introduce solid foods. Aponjon messages informed me to prepare the first solid food-"shuji" [semolina] with a pinch of salt. Aponjon also taught me that baby would take first solids in small proportion and gradually the amount would increase." Participant woman 23

"Well, I did not know a lot of information that I have learnt from Aponjon messages for my second child who is 8 years younger than my first born. Aponjon reminded me what to do in every step which I found quite useful…Aponjon informed me about baby's jaundice symptoms and what to do. My daughter [second one] had symptoms of jaundice, so I used to keep her in the sunlight." Participant woman 2.

Participant women found the messages useful and recommended the service to other pregnant women in their neighborhood or in the same household. Information on danger signs encouraged subscriber women to contact local health facilities frequently. Additionally, women received personalized advice from Aponjon's 24*7 doctor's consultation service (Alam et al., 2019):

"If I came across any problem I talked to the Doctor Apa [doctor at the Aponjon's consultation service] and discussed my child"s health with her. She advised me and I did not have to take my child to visit a doctor for small [non-urgent] queries. My child used to vomit after I breastfed...The Doctor Apa told me that I should not breastfeed my daughter lying on the bed. And also asked me to put her on my shoulder and gently rub her back after each feed. So the undigested milk would get out. It was a very good advice." Participant woman 2.

3.1.2 Involvement of husbands

In low- income households where women were less educated and not involved in income generating works, husband's encouragement was essential for women's adoption of the service. Participant women were able to utilize the service better and remembered to follow the recommendations when their husbands were regularly involved in receiving and relaying messages:

"At around 6 months, I started giving my child "khichuri" [smashed rice with lentil and vegetables] beside

breast milk. My husband received messages from Aponjon on how to make khichuri and other stuff for my baby. He used to tell me all this information after returning home from work. I followed those instructions and was benefitted…He asked me to contact the doctors by dialing the short code to discuss child's symptoms [such as fever]. He said they [the doctors] would tell me what to do." Participant woman 17.

"My husband recorded the messages [when he was not at home with his phone], so when he came back [home] I listened to the messages as many times as I wanted. My nonod [sister-in-law] also listened together with me." Participant woman 15.

3.2 Theme-2: Perceived Barriers

3.2.1 Access to Messages

Participant women reported various challenges that they had encountered while accessing the service, mostly due to network issues in their local area, loss of phone, faulty phones, problem with charging of mobile phone battery and frequent change of SIMs; barriers that were reported by users in other resource limited settings (Amoakoh-Coleman et al., 2016; Barron et al., 2018; mWomen, 2012; Obasola, Mabawonku, & Lagunju, 2015; Watson, Sabumei, Mola, & Iedema, 2015). Additionally, messages were often not accessed because participant women had forgotten to keep adequate balance in the phone or did not find the information interesting. However, lack of personal phone and coordination with family members in arranging shared phone sets stood out to be the foremost barrier that prevented participant women from getting regular weekly information (Huq, Azmi, Quaiyum, & Hossain, 2014; Khatun et al., 2017; Poorman, Gazmararian, Elon, & Parker, 2014; Tran et al., 2015). Participant women, who did not own their phones or shared phones with family members, relied heavily on the phone owners to access the messages. Because voice messages were programmed to be sent out on a specific time of specific days of the week according to subscriber women's preference during the time of enrollment, it was essential that the phone owning family member passed on messages to the subscriber women:

"I did not have my own phone [at that time], so I was registered in my husband's phone which stayed with him most of the time. He listened to the messages but never found the time [as he remained busy at work] to relay the information to me." Participant woman 24.

3.2.2 Literacy

Literacy for mHealth can be of two types: the ability to operate mobile phones efficiently and the ability to comprehend voice or text messages. Although Aponjon provides voice and text messages at the same price, most respondents opted to receive voice messages which only required basic literacy to receive the phone call. However, interviews suggested low literate participant women could not follow voice messages and preferred consultation of health workers. On the other hand the transliterated text messages, which had the advantages of being stored and read at leisure period over voice messages, were welcomed by women who received higher education and were able to send or receive text messages on their own (Datta, Ranganathan, & Sivakumar, 2014; Khatun et al., 2016):

"I think for [low-literate] people in the village "uthan boithok" [group counseling organized at someone"s courtyard] is better where Shebika [health worker] discusses different topics and issues with a group of people. How many people [can] use the mobile phone tell me? So, it is better if they can gather and talk to the Shebika about their problems." Participant woman 28.

3.2.3 Service Knowledge

Although some participants accessed the Aponjon medical consultation service for urgent or non-urgent symptoms and clarified issues with these doctors, many participants were not aware of such service. Yet some participants were unaware of the schedules of messages every week while some others did not know how to contact the service providers by dialing the short code for service related issues:

"I wanted to enroll for my second baby. But Health worker Apa who enrolled me for my first child did not visit me for the second one. I didn't know how to enroll again." Participant woman 11.

3.2.3 Willingness to Pay

Although subscribers are generally informed about the pricing policy prior to enrollment, we found mixed opinion from the participants. Participants who frequently accessed the messages found the service affordable. On contrary pricing policy of the service may have deterred some participants from accessing the messages:

"The company [Aponjon] took money [call charges] away from me, so I didn't pick up the calls." Participant woman 7.

"I first thought of stopping the service [during pregnancy], because of the service price. But later [after childbirth] I realized that the service charge [2 taka per message] was very nominal considering the information I received. It's all for the benefit of my child, right? Who would give such [useful] information?" Participant woman 10.

3.3 Theme-3: Healthcare Practices and Norms

3.3.1 Traditional Practices

Although Aponjon advises subscribers to organize safe delivery with skilled birth attendants and to follow essential newborn care guidelines, cultural influences may prevent women from adopting recommended practices. It was common for our participants from low income households to report using a mix of biomedical and traditional non- western practices during birth and the postnatal period. Similar to past studies that explored delivery practices among low- income households in Bangladesh, there were a few participants who had deliveries at home with untrained birth attendants; a tradition that had been passed down in families for generations (Choudhury & Ahmed, 2011). Other reasons for a home based delivery were cost of delivery at hospitals, fear of C-sections, convenience and lack of family members to accompany participants to hospital. Before organizing their deliveries at home most participant women confirmed with designated health workers that their pregnancy was normal. Participant women had little autonomy during home based deliveries; mostly deliveries were organized by their mothers or mothers-in- law. Husbands sometimes became involved when there were complications during delivery and a pregnant woman had to be removed to a health facility. Mothers or mothers-in-law usually handpicked the *Dai* (traditional birth attendant) depending on her years of experience and success at delivering live births in the community rather than her professional training. Although participants could not always confirm whether the *Dai* who assisted her during delivery had received any formal training, felt confident in their capabilities.

Essential neonatal practices such as wiping, drying and wrapping the newborn baby, proper cord care, delaying of first bath of the baby for at least 24 hours (delay is recommended up to 72 hours in Bangladesh) and initiation of breastfeeding right after birth (usually within an hour) requires assistance from people involved in the delivery process (National Institute of Population Research and Training, 2016). These practices were overruled because traditional remedies and adherence to cultural rituals were trusted due to the influence of elderly female family members; a finding consistent with previous studies on delivery and newborn care practices in Bangladesh (Darmstadt, Syed, Patel, & Kabir, 2006):

"The Dai [trained] asked my mum to wait 3 days before bathing the baby. But my mum and Chachi [aunt] did not listen and bathed the baby right after birth. Chachi said the baby wasn't looking clean [because of the attached mucus and blood from mother's uterus]." Participant woman 12

"My mum gave the baby "michri pani" [water mixed with palm sugar which is considered good]. We don"t give honey [to newborn baby]. I gave both my children breast milk after three days." Participant woman 1

"I put mustard oil with betel leaf around the [umbilical] stump area [to dry up soon]. I preserved the stump in a drawer [because] Murubbi [the elderly people] asked to feed the children stump- washed water to cure stomach cramps." Participant woman 27

Although antenatal care visits helped participants understand their pregnancy progression, participants who had deliveries at home with untrained *Dai*s, were less likely to receive postnatal care visits, particularly if they had relocated to their parents' house before delivery and had lost contact with their health worker. Postnatal visits were deemed necessary only when there was a perceived need for maternal or neonatal illnesses. It was common among participants from low income households to adopt traditional sources of care, homeopathy or remedy from the *grammo daktar* (village doctor) for newborn babies, considering no or minimal side effects.

3.3.2 Biomedical Services

In general, there is an increasing normalization of westernized medical care practices in pregnancy, childbirth and postnatal period, irrespective of mobile phone based educational messages. Our participants had access to formal healthcare providers such as community health workers, paramedics or medically trained doctors who provided advice and treatment. Often, previous negative birthing experiences such as a stillbirth, delivery related complications or delay in reaching the hospital encouraged participants to access health facilities in the hope of a better outcome next time. After a facility based delivery, women, who otherwise would follow traditional practices at home guided by an elderly family member, adopted recommended postpartum health practices at doctor's advice:

"Nowadays the doctors advise [after delivery at hospital] not to put anything [mustard oil] on the umbilical stump and gives a medicine [instead] if it does not dry up." Participant woman 13

"Even if it is a normal delivery, the baby won't be given a bath right after bath….. Whatever you want to do now, you have to first consult a doctor." Participant woman 25

Whether the births took place at home or at a health facility, participants confirmed that they were aware of free vaccines at the monthly local health camps due to the house visits from vaccine providers and phone-call reminders from the national immunization program, and had never missed an immunization schedule for their children.

However, cost determined the type of facility women visited for pre- and postnatal cares. While subsidized or free services at public or NGO-run maternal facilities remained a feasible option for participant women from low income households, wealthier or more highly educated women were able to visit gynecologists often and organize delivery at private hospitals.

4. Discussion

Our research has implications for women's adoption of mHealth services and the position of mHealth within the existing health system and broader socio-cultural context. Participants in our study recognized the relative advantage of signing up to the service and were part of a social network that inspired other potential pregnant women to sign up as well (Rogers, 1983). We found that women responded positively to, and were likely to adopt, some of the health information provided by Aponjon mobile phone messages, particularly those related to newborn nutrition and care of newborn babies that could be performed at a household level. We infer that mHealth messages coupled with nutrition supplements have the potential to improve nutritional deficiency among infants in Bangladesh (GAIN, 2014; National Institute of Population Research and Training, 2016) and we recommend a proper observational study design to understand the effects.

Our findings suggest that traditional birthing practices and post-natal care, such as home-based deliveries by untrained *Dai*s, are increasingly being used in conjunction with, or are being replaced by biomedical services and recommendations (National Institute of Population Research and Training, 2017). While Aponjon's messages have supported this transition to a western health model, many of these practices are taking place independently. There has been continued investment in health infrastructure, medical equipment, capacity building in formal healthcare, improved health systems governance and monitoring, demand-side-financing schemes and an extensive door-to-door health worker campaign strategy by the Government and NGOs (El Arifeen et al., 2013; Ministry of Health and Family Welfare, 2015; MOHFW, 2018). Research elsewhere suggests that mHealth interventions are less likely to show significant improvements in outcome indicators in high-performing health areas (Hategeka, Ruton, & Law, 2019) and that targeted messages may increase awareness and readiness around delivery and special care for premature babies among pregnant women who have an increased risk of preterm births (Olivia Kim et al., 2019).

Therefore, we suggest mHealth interventions will work best with targeted groups who need help most, particularly adolescent women in context of Bangladesh. Teenage pregnancy remains a problem in Bangladesh as one-third of 15-19 year old girls are likely to experience pregnancy before reaching adulthood and are at risk of contributing to a pregnancy related mortality ratio that has doubled between 2010 and 2016 (Islam, Islam, Hasan, & Hossain, 2017; National Institute of Population Research and Training, 2017). Culturally acceptable mHealth messages on contraception and reproductive health that worked in other resource limited settings could reduce teenage pregnancies in Bangladesh (Vahdat, L'Engle, Plourde, Magaria, & Olawo, 2013).

Like other studies (Brinkel, Dako-Gyeke, Kramer, May, & Fobil, 2017; Khatun et al., 2017; Khatun et al., 2016), we found that mobile phone ownership, literacy, technological functionality and involvement of significant others has determined service adoption practices of participants in our study. The operational challenges of providing Bangla text messages encountered by Aponjon is likely to be overcome in coming years by the increasing availability of smart phones that support Bangla fonts and new legislation from Bangladesh Telecommunication Regulatory Commission (BTRC) asking telecom operators to send messages to their clients in Bangla fonts (Tribune, 2016, 2018). Nevertheless, subscribers need training to access SMS. Along with technological support, husband's endorsement of the service is crucial for availing the phone and support for entire period of child birth. A study in India found that there were improved pre- and postnatal visits and adherence to newborn babies' delayed bathing among women whose husbands passed on information from the voice messages (Hazra, Khan, & Mondal, 2018). We suggest that husbands should be encouraged to access the service during enrollment, to share information with their wives and to consult the hotline service for delivery

emergencies and neonatal complications, especially in low- income households where women are not confident with using technology (Alam et al., 2019). Also, women should be encouraged to listen to the messages along with elderly female family members who coordinate delivery and neonatal care practices in low income households. Making the service accessible to the household acknowledges that birthing and raising children is a family rather than an individual practice.

Our findings suggest that subscription charges may discourage subscribers who are reluctant to pay for educational messages, although our research on Aponjon counseling line suggests families were willing to pay to consult doctors at the call centers (Alam et al., 2019) meaning that subscribers preferred personal interactions and real-time personal advice which is missing in one-way general messages (Rajan et al., 2013). While cash incentives (Muller et al., 2019) and free-talk times (Lund et al., 2012) for accessing health facilities and healthcare providers may improve delivery and new born indicators in low- income households, more should be done. A referral service linked with local health facilities and organized house-visits by local healthcare providers would improve health outcomes and retention of subscribers (Huq et al., 2014; Jo et al., 2014; Watson et al., 2015).

We identified a gap in the community health workers' recruitment information as most participants were unaware of the consultation service with doctors or how to contact the call center for service upgrades or re-enrollment. Some participants had provided mobile phone numbers of family members to recruiters that they did not access. Since community health workers remain a major medium for reaching and recruiting women in the remotest households to mHealth services, it is important that health workers understand how mobile phones are used by households, and that they inform subscribers clearly about the purpose of the messages, billing method of the service and how to access the messages, the consultation service and the service call center. This requires on-going training and monitoring (Rajan et al., 2013).

Our study is limited by a number of factors. First, we cannot exclude the possibility of recall bias among participants, as they were re-contacted almost two years after they were surveyed in 2014. Second, it was difficult to ascertain how frequently women accessed the messages especially on shared phones; accessing service data on participants' usage could add value to their self-reported experiences. Third, our study lacked experience of SMS subscribers in low- income households as they preferred voice messages over transliterated Bangla text messages.

Offering women the option of Bangla SMS may encourage low- income households to enroll in the text message service thus improving their experience with "missed messages".

5. Conclusion

This exploratory study which documents the experiences of early adopters of a mobile phone based education service around delivery and newborn care practices in Bangladesh can provide valuable lessons for mHealth implementers and policy makers in similar cultural settings. The service could be expanded to include messages on women's health and health tips for well-being of under-5 and older children. For example, there is a growing unaddressed problem of obesity among urban women and the double burden of malnutrition among children in Bangladesh (National Institute of Population Research and Training, 2016). mHealth services, if they are well delivered, monitored and thoroughly evaluated, may contribute to improving a range of health issues in resource poor settings.

Competing Interests Statement

The authors declare no potential conflicts of interest. The views in the publication are those of the authors only and do not necessarily reflect the views of the institutions involved in this publication.

References

Ahmed, T., Lucas, H., Khan, A. S., Islam, R., Bhuiya, A., & Iqbal, M. (2014). eHealth and mHealth initiatives in Bangladesh: a scoping study. *BMC Health Serv Res, 14*, 260. https://doi.org/10.1186/1472- 6963-14-260

Alam, M., Banwell, C., Olsen, A., & Lokuge, K. (2019). Patients' and Doctors' Perceptions of a Mobile

Phone-Based Consultation Service for Maternal, Neonatal, and Infant Health Care in Bangladesh: A Mixed-Methods Study. *JMIR Mhealth Uhealth, 7*(4), e11842. https://doi.org/10.2196/11842

Alam, M., D'Este, C., Banwell, C., & Lokuge, K. (2017). The impact of mobile phone based messages on maternal and child healthcare behaviour: a retrospective cross-sectional survey in Bangladesh. *BMC Health Serv Res, 17*(1), 434. https://doi.org/10.1186/s12913-017-2361-6

Amoakoh-Coleman, M., Borgstein, A. B., Sondaal, S. F., Grobbee, D. E., Miltenburg, A. S., Verwijs, M., . . . Klipstein-Grobusch, K. (2016). Effectiveness of mHealth Interventions Targeting Health Care Workers to Improve Pregnancy Outcomes in Low- and Middle-Income Countries: A Systematic Review. *J Med Internet Res, 18*(8), e226. https://doi.org/10.2196/jmir.5533

Barron, P., Peter, J., LeFevre, A. E., Sebidi, J., Bekker, M., Allen, R., . . . Pillay, Y. (2018). Mobile health messaging service and helpdesk for South African mothers (MomConnect): history, successes and challenges. *BMJ Glob Health, 3*(Suppl 2), e000559. https://doi.org/10.1136/bmjgh-2017- 000559

Bangladesh Bureau of Statistics [BBS]. (2019). District Statistics. Retrieved from http://www.bbs.gov.bd/site/page/2888a55d-d686-4736-bad0-54b70462afda/-

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Brinkel, J., Dako-Gyeke, P., Kramer, A., May, J., & Fobil, J. N. (2017). An investigation of users' attitudes, requirements and willingness to use mobile phone-based interactive voice response systems for seeking healthcare in Ghana: a qualitative study. *Public Health, 144*, 125-133. https://doi.org/10.1016/j.puhe.2016.11.017

Bangladesh Telecommunication Regulatory Commission [BTRC]. (2012). Mobile subscription data in Bangladesh. Retrieved from http://www.btrc.gov.bd/telco/mobile

Choudhury, N., & Ahmed, S. M. (2011). Maternal care practices among the ultra poor households in rural Bangladesh: a qualitative exploratory study. *BMC Pregnancy Childbirth, 11*, 15. https://doi.org/10.1186/1471-2393-11-15

Chowdhury, M. E., Shiblee, S. I., & Jones, H. E. (2019). Does mHealth voice messaging work for improving knowledge and practice of maternal and newborn healthcare? *BMC Med Inform Decis Mak, 19*(1), 179. https://doi.org/10.1186/s12911-019-0903-z

Colaci, D., Chaudhri, S., & Vasan, A. (2016). mHealth Interventions in Low-Income Countries to Address Maternal Health: A Systematic Review. *Ann Glob Health, 82*(5), 922-935. https://doi.org/10.1016/j.aogh.2016.09.001

Darmstadt, G. L., Syed, U., Patel, Z., & Kabir, N. (2006). Review of domiciliary newborn-care practices in Bangladesh. *J Health Popul Nutr, 24*(4), 380-393.

Datta, S. S., Ranganathan, P., & Sivakumar, K. S. (2014). A study to assess the feasibility of Text Messaging Service in delivering maternal and child healthcare messages in a rural area of Tamil Nadu, India. *The Australasian medical journal, 7*(4), 175-180. https://doi.org/10.4066/AMJ.2014.1916

Directorate Genral of Health Services [DGHS]. (2012). *Health Bulletin 2012*. Dhaka Retrieved from http://dghs.gov.bd/bn/licts_file/images/Health_Bulletin/HealthBulletin2012_full.pdf.

El Arifeen, S., Christou, A., Reichenbach, L., Osman, F. A., Azad, K., Islam, K. S., . . . Peters, D. H. (2013). Community-based approaches and partnerships: innovations in health-service delivery in Bangladesh. *Lancet, 382*(9909), 2012-2026. https://doi.org/10.1016/s0140-6736(13)62149-2

Friese, S. (2012). *Qualitative data analysis with Atlas. Ti* (1st ed.): Sage.

GAIN. (2014). *A child's daily nutrition within a small sachet*. Retrieved from Geneva: https://www.gainhealth.org/wp-content/uploads/2014/04/63.-Case-Story.-A-childs-daily-nutrition-within-a-small-sachet.-Micronutrient-Powders-in-Bangladesh..pdf

Hategeka, C., Ruton, H., & Law, M. R. (2019). Effect of a community health worker mHealth monitoring system on uptake of maternal and newborn health services in Rwanda. *Glob Health Res Policy, 4*, 8. https://doi.org/10.1186/s41256-019-0098-y

Hazra, A., Khan, M. E., & Mondal, S. K. (2018). Mobile Phone Messaging to Husbands to Improve Maternal and Child Health Behavior in India. *J Health Commun*, 1-8.

https://doi.org/10.1080/10810730.2018.1483444

Huq, N. L., Azmi, A. J., Quaiyum, M. A., & Hossain, S. (2014). Toll free mobile communication: overcoming barriers in maternal and neonatal emergencies in Rural Bangladesh. *Reprod Health, 11*, 52. https://doi.org/10.1186/1742-4755-11-52

Islam, M. M., Islam, M. K., Hasan, M. S., & Hossain, M. B. (2017). Adolescent motherhood in Bangladesh: Trends and determinants. *PLoS One, 12*(11), e0188294. https://doi.org/10.1371/journal.pone.0188294

Jo, Y., Labrique, A. B., Lefevre, A. E., Mehl, G., Pfaff, T., Walker, N., & Friberg, I. K. (2014). Using the lives saved tool (LiST) to model mHealth impact on neonatal survival in resource-limited settings. *PLoS One, 9*(7), e102224. https://doi.org/10.1371/journal.pone.0102224

Khatun, F., Heywood, A. E., Hanifi, S. M. A., Rahman, M. S., Ray, P. K., Liaw, S. T., & Bhuiya, A. (2017). Gender differentials in readiness and use of mHealth services in a rural area of Bangladesh. *BMC Health Serv Res, 17*(1), 573. https://doi.org/10.1186/s12913-017-2523-6

Khatun, F., Heywood, A. E., Ray, P. K., Bhuiya, A., & Liaw, S. T. (2016). Community readiness for adopting mHealth in rural Bangladesh: A qualitative exploration. *Int J Med Inform, 93*, 49-56. https://doi.org/10.1016/j.ijmedinf.2016.05.010

Langlois, E. V., Miszkurka, M., Zunzunegui, M. V., Ghaffar, A., Ziegler, D., & Karp, I. (2015). Inequities in postnatal care in low- and middle-income countries: a systematic review and meta-analysis. *Bull World Health Organ, 93*(4), 259-270g. https://doi.org/10.2471/blt.14.140996

Lund, S., Hemed, M., Nielsen, B. B., Said, A., Said, K., Makungu, M. H., & Rasch, V. (2012). Mobile phones as a health communication tool to improve skilled attendance at delivery in Zanzibar: a cluster- randomised controlled trial. *Bjog, 119*(10), 1256-1264. https://doi.org/10.1111/j.1471- 0528.2012.03413.x

Ministry of Health and Family Welfare, Partnership for Maternal, Newborn & Child Health, World Health Organization, World Bank and Alliance for Health Policy and Systems Research. (2015). *Success factors for women's and children's health*. Retrieved from https://apps.who.int/iris/handle/10665/178623

Ministry of Health and Family Welfare[MOHFW]. (2018). *Health Bulletin*. Dhaka Retrieved from http://dghs.gov.bd/images/docs/Publicaations/HB%202018%20v2.pdf

Muller, N., Emmrich, P. M. F., Rajemison, E. N., De Neve, J. W., Barnighausen, T., Knauss, S., & Emmrich, J. V. (2019). A Mobile Health Wallet for Pregnancy-Related Health Care in Madagascar: Mixed- Methods Study on Opportunities and Challenges. *JMIR Mhealth Uhealth, 7*(3), e11420. https://doi.org/10.2196/11420

GSMA mWomen. (2012). *Striving and Surviving: Exploring the Lives of Women at the Base of the Pyramid*. Retrieved from https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/01/GSMA_mWomen_Striving_and_Surviving-Exploring_the_Lives_of_BOP_Women.pdf

National Institute of Population Research and Training, Mitra and associates, and ICF International. (2016). *Bangladesh Demographic and Health Survey 2014*. Retrieved from Dhaka, Bangladesh, and Rockville, Maryland, USA: https://dhsprogram.com/pubs/pdf/FR311/FR311.pdf

National Institute of Population Research and Training, Mitra and associates, and ICF International. (2017). *Bangladesh Maternal Mortality and Health Care Survey 2016: Preliminary report*. Retrieved from Dhaka, Bangladesh, and Chapel Hill, NC, USA: NIPORT, ICDDRB and MEASURE Evaluation: https://www.measureevaluation.org/resources/publications/tr-17-218

Obasola, O. I., Mabawonku, I., & Lagunju, I. (2015). A Review of e-Health Interventions for Maternal and Child Health in Sub-Sahara Africa. *Matern Child Health J, 19*(8), 1813-1824. https://doi.org/10.1007/s10995-015-1695-0

Olivia Kim, U., Barnekow, K., Ahamed, S. I., Dreier, S., Jones, C., Taylor, M., . . . Basir, M. A. (2019). Smartphone-based prenatal education for parents with preterm birth risk factors. *Patient Educ Couns, 102*(4), 701-708. https://doi.org/10.1016/j.pec.2018.10.024

Poorman, E., Gazmararian, J., Elon, L., & Parker, R. (2014). Is health literacy related to health behaviors and cell phone usage patterns among the text4baby target population? *Arch Public Health, 72*(1), 13. https://doi.org/10.1186/2049-3258-72-13

Rajan, R., Raihan, A., Alam, M., Agarwal, S., Ahsan, A., Bashir, R., . . . Labrique, A. B. (2013). *MAMA 'Aponjon'*

Formative   Research   Report.   Retrieved   from   Baltimore,   MD,   USA: http://www.aponjon.com.bd/pdf_view_report/aponjon_report_56a092170a5b9.pdf

Rogers, E. M. (1983). Attributes of innovation and their rate of innovation. In *Diffusion of Innovations* (pp. 210-238). New York, NY. USA: The Free Press.

Speciale, A. M., & Freytsis, M. (2013). mHealth for midwives: a call to action. *J Midwifery Womens Health, 58*(1), 76-82. https://doi.org/10.1111/j.1542-2011.2012.00243.x

Tran, M. C., Labrique, A. B., Mehra, S., Ali, H., Shaikh, S., Mitra, M., . . . West, K., Jr. (2015). Analyzing the mobile "digital divide": changing determinants of household phone ownership over time in rural bangladesh. *JMIR Mhealth Uhealth, 3*(1), e24. https://doi.org/10.2196/mhealth.3663

Tribune.   (2016).   Smartphone   on   the   rise.   *Dhaka   Tribune*.   Retrieved   from https://www.dhakatribune.com/uncategorized/2016/01/23/smartphone-users-on-the-rise

Tribune. (2018). BTRC asks mobile operators not to send Bangla messages in English. *Dhaka Tribune*. Retrieved   from   https://www.dhakatribune.com/business/regulations/2018/09/05/btrc-asks-mobile-operators-not-to-send-bangla-messages-in-english

Vahdat, H. L., L'Engle, K. L., Plourde, K. F., Magaria, L., & Olawo, A. (2013). There are some questions you may not ask in a clinic: providing contraception information to young people in Kenya using SMS. *Int J Gynaecol Obstet, 123 Suppl 1*, e2-6. https://doi.org/10.1016/j.ijgo.2013.07.009

Watson, A. H. A., Sabumei, G., Mola, G., & Iedema, R. (2015). Maternal Health Phone Line: Saving Women in Papua New Guinea. *Journal of Personalized Medicine, 5*, 120-139. https://doi.org/10.3390/jpm5020120

World Health Organization [WHO]. (2017). *WHO recommendations on maternal health: guidelines approved by the WHO guidelines review committee*. Retrieved from Geneva: World Health Organization: https://apps.who.int/iris/bitstream/handle/10665/259268/WHO-MCA-17.10-eng.pdf;jsessionid=FA81153DFF59BABA6E4E48FA682FDC5B?sequence=1

World Health Organization [WHO]. (2018). *Maternal mortality: Key facts*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/maternal-mortality

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