Where there is no phone: The benefits and limitations of using intermediaries to extend the reach of mHealth to individuals without personal phones in Malawi

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Abstract

The purpose of this study is to identify the benefits and limitations associated with intermediaries to provide access to and increase utilization of an mHealth intervention amongst people without personal phones in Balaka District, Malawi. A mixed-methods approach was utilized including quantitative data on usage and focus groups and interviews with users and volunteers. Community volunteers equipped with mobile phones served as intermediaries and were critical access points to the service for users without personal phones. However, there were challenges maintaining phones and solar panels, sustaining volunteer motivation and understanding how to use the service. While these strategies had a number of limitations, the majority of users (more than 65%) were individuals without a personal phone, who may not have been able to access the service otherwise. Further research is needed to better understand the resources, strategies and effort needed to sustain access through intermediaries in the long-term.

Keywords: mHealth; Intermediaries; Phone access; Maternal and child health; Malawi

Résumé

L'objectif de cette étude est d'identifier les bénéfices et les limites de l'utilisation des intermédiaires pour permettre l'accès et améliorer l'utilisation d'une intervention mSanté chez les personnes n'ayant pas de téléphone personnel dans le district de Balaka au Malawi. Une approche mixte a été utilisée : des données quantitatives sur l'utilisation du téléphone ont été collectées, et des groupes de

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discussion et entrevues avec des usagers et des volontaires ont été organisés. Les volontaires équipés d'un téléphone mobile dans la communauté ont servi d'intermédiaires et ont été des points d'accès critiques au service pour les personnes n'ayant pas de téléphone personnel. Cependant, maintenir les téléphones et les panneaux solaires, soutenir la motivation des volontaires, et comprendre comment utiliser le service ont été de véritables défis. Bien que toutes ces stratégies présentent certaines limites, la majorité d'utilisateurs (plus de 65%) étaient des personnes n'ayant pas de téléphone, et qui n'auraient pas pu accéder autrement aux services offerts. D'autres recherches sont nécessaires pour mieux comprendre les ressources, les stratégies et les efforts requis pour soutenir l'accès au service à long terme par l'utilisation des intermédiaires.

Mots clés: mSanté; Intermédiaires; Access au téléphone; Santé de la mère et de l'enfant; Malawi

Introduction

There is rapidly increasing interest in the use of mobile technology for health (mHealth) in low- and middle- income countries. Emerging evidence suggests that mHealth initiatives offer innovative approaches to providing health information and delivering healthcare services (Aranda Jan et al. 2014; Evans, Waller & Snider; 2012; Lund et al. 2012; Tamarat & Kachnowksi; 2012; Sharma et al. 2011). mHealth has gained momentum in Africa where rapid growth in mobile phone access is seen as a solution to ameliorate human, economic and infrastructure shortages of health systems (Labrique et al. 2013; Mars 2013; Zurovac et al. 2014). mHealth is now used in many small scale projects to facilitate disease and outbreak surveillance, supply chain management, treatment compliance, quality of care, hospital attendance and provision of health information and behavior change (Labrique et al 2013; Zurovec et al. 2014; Evans, Waller & Snider; 2012; Lund et al. 2012; Tamarat & Kachnowksi; 2012; Sharma et al. 2011).

However, little is known about whether mHealth is an effective way to reach disadvantaged communities where telecom infrastructure and phone access are limited (Glasgow, Phillips & Sanchez 2014). While more than 60% of people living in Africa live within range of a mobile network, this access is not equally distributed (Akar & Mbitie 2010; Mars 2013). Areas with low population density and low per capita income are the least likely to have network access (Akar & Mbitie 2010; Mars 2013).

In these settings, mobile phone ownership and telecom subscription rates are even lower than access rates (James & Versteeg 2007). This is in part because the cost of mobile phones and services is an intractable barrier for many (Etzo & Collender 2010; Rashid & Elder 2009). The cost of owning a mobile phone and subscribing to service can account for nearly 10% of monthly income for individuals living in low income countries (GSMA Mobile for Development Intelligence 2014). Etzo and Collender state that the unequal ability to use mobile phones may be "widening the gap between the poor

and the poorest" (2009: 665). Because of cost and other barriers, women and individuals living in rural areas are the least likely to subscribe to a telecom service or own a mobile phone (Rashid & Elder 2009; Wesolowski et al. 2012; Zurovac et al. 2013). There are 300 million fewer female than male mobile phone subscribers in low- and middle-income countries and a woman in Africa is 23% less likely to own a phone than a man (Vital Wave Consulting 2010). Women often cite the cost of phones and mobile services, a lack of need and a fear of being able to master the technology as reasons for not owning a phone (Vital Wave Consulting 2010).

While barriers to phone access, subscription, and ownership are well identified, there is little data on actual phone usage in sub-Saharan Africa (Akar & Mbiti 2010; Rashid & Elder 2009; Wesolowski et al. 2012). The number of phone owners and subscribers to a telecom service are not equivalent to number of people using mobile phones as the widely recognized practice of sharing phones in Africa means there may be considerably more users than subscribers (James & Versteeg, 2007; Akar & Mbiti, 2010). Phones are shared in a variety of ways including informal sharing between family and friends (usually without a charge) and through public pay-for-use services (James & Versteeg, 2007). Studies in South Africa and Kenya found that approximately 30% of phone owners shared their mobile phone with others (Akar & Mbiti 2010, Crankshaw et al. 2010). The South African study suggests women are even more likely to share phones than men (Crankshaw et al. 2010). Those who share phones or use a public payphone face additional challenges accessing mHealth services such as phone availability, convenience, privacy, feasibility of receiving text messages, retention of information and cost (Jennings et al. 2013; Mechael et al. 2010).

Limited phone ownership and phone access and lack of understanding of mobile phone usage patterns is problematic for mHealth interventions that target services at women, poor individuals or communities living in rural areas who are least likely to have access to a mobile network or phone; the same populations that may derive the most benefit from mHealth. Existing mHealth projects, such as the Mobile Technology for Community Health (MOTECH) initiative in Ghana and the Wired Mothers project in Zanzibar have reported significant barriers reaching those without personal phones (Lund 2012; MOTECH 2011).

There is currently little documentation on how to tailor mHealth programs to reach individuals in environments with low phone ownership. A number of projects have distributed phones directly to end users (Chaiyachati et al., 2013; Chib 2010; Ngabo et al. 2012). These programs, however, usually target a limited number of end users. Another option is to use intermediaries such as volunteers equipped with phones to facilitate access and use of mHealth services. While the use of intermediaries has the potential to expand interventions without requiring provision of mobile technology to all potential users, there are no studies, to our knowledge, that explore the benefits and limitations of using intermediaries as access points for mHealth users without personal phones.

Chipatala cha pa Foni (CCPF) – or Health Center by Phone – the subject of this paper, is designed to mitigate barriers to accessing maternal and child health information and services by extending the reach of the health system to women of childbearing age, pregnant women, and caregivers of young children in Malawi. Malawi has some of the highest maternal and neonatal mortality rates in the world (World Health Organization et al. 2014; National Statistical Office and ICF Macro 2011). Contributing factors to mortality and morbidity include poor access to health information and health services. For example, an estimated 28% of pregnant women in Malawi do not give birth in a health facility and 67% of women don't receive a postnatal checkup within 48 hours of giving birth (National Statistical Office and ICF Macro 2011). As is true in many low-income areas, these barriers are exacerbated for women living in rural areas, where long distances to health facilities, lack of transportation and poor road infrastructure make accessing health information and services even more challenging.

There is limited data on mobile phone usage in Malawi, but the data available indicate that mobile phone ownership in rural Malawi, especially among women, remains low. A baseline study of 1,600 households in the area where CCPF was piloted found that only 45% of households in the target area owned a phone (Invest in Knowledge 2012).

CCPF has two main components: 1) A toll-free hotline which both provides clients with information and advice on reproductive, maternal and child health issues and refers callers reporting "danger signs" for further care at a village clinic, health center, or district hospital; and 2) An optional "tips and reminders" mobile messaging service that provides regular text or voice messages on reproductive, maternal, and newborn health topics. Messages are tailored to the user's week of pregnancy or their child's age.

The purpose of this study is to identify the benefits and limitations associated with using community volunteers equipped with mobile phones to provide access to and increase utilization of CCPF amongst people without personal phones.

Data and Methods

Study Design

A mixed-methods approach was utilized to evaluate the pilot project. Quantitative data on usage of the hotline and tips and reminders service were collected monthly from July 2011 to June 2013 and a cross-sectional qualitative data on user and volunteer experience were collected in May and June of 2013. For this study, the authors conducted a secondary review of the qualitative data collected for the project evaluation as described in the Data Analysis section.

Intervention Activities

The CCPF pilot was conducted from July 2011 to June 2013 as a part of Concern Worldwide's *Innovations for Maternal, Newborn & Child Health Initiative*. Local implementation in Malawi was led by VillageReach, in partnership with the Malawi Ministry of Health and Baobab Health Trust.

Due to low household phone ownership and the assumption that the target population for the service – women - are the least likely members of a household to have access to a phone,

CCPF was designed to be accessible to users without personal phones. One or two volunteers were chosen in each village to act as intermediaries by providing access to and generating demand for the CCPF service. Each volunteer was given a low-cost phone which could be used by anyone to access the CCPF hotline or tips and reminders service. Groups of approximately five volunteers living in the same area were given solar panels to share for charging their phones. Volunteers were also responsible for promoting CCPF through one-on-one and small group outreach, by distributing flyers and talking about the service at community events.

Enrollees to the tips and reminders service could either have messages sent to their personal phones or use any phone (including phones of family members, friends, or volunteers) to access their weekly voice message through the use of an interactive voice response (IVR) system. An IVR allows clients to interact with computerized systems through voice or keypad input and to be directed to the desired service. To access CCPF tips and reminders, users call the toll-free IVR system, follow the menu prompts, and then enter the appropriate access code to hear their message. Pregnant women used their estimated due date as their code, caregivers of children used the child's birthdate and women of childbearing age used their CCPF registration date. Volunteers were trained on how to help users access tips and reminders through the IVR system.

Data Collection

Quantitative data on hotline and tips and reminders usage were collected between July 2011 and June 2013 from two sources: the hotline database where hotline workers electronically enter information about callers during calls and the IVR server where data on incoming calls are automatically collected. During calls, hotline workers enter information about the caller and the call outcome into the hotline database via a touchscreen-enabled computer terminal. Hotline workers did not collect data on the phone the user called from (community volunteer phone or other) or whether or not the user owned their own phone. As a proxy for phone ownership, we looked at whether callers gave a personal phone number when they registered for CCPF services. Those with any number listed were counted as callers who registered with a personal phone; those who gave no phone number were counted as callers who registered without a personal phone.

Qualitative data from focus groups and in-depth interviews with community volunteers, users of CCPF, and women of childbearing age were collected during an evaluation of the CCPF conducted by Invest in Knowledge Initiative (IKI). Methods of this evaluation are available elsewhere (IKI 2013) but a summary of methods relevant to this article is provided here. Data were collected from May-June 2013 using two types of qualitative methods:

1. **Focus group discussions (FGDs):** Focus groups discussions were held with women from the intervention area. Women were categorized by their responses to exposure questions on a household survey (those who used CCPF, those who had heard of CCPF but had never used it and those who had not

heard of CCPF) and then randomly selected. Approximately 10 women participated in each focus group discussion.

2 **In-depth interviews (IDIs):** The "most talkative" woman in the focus groups of women who had used CCPF and women who had heard of CCPF but not used it were chosen for in-depth interviews.

3 **Key Information Interviews (KIIs):** Two key informant interviews were conducted with CCPF community volunteers from each catchment area.

Table 1 shows participant description and number of FGDs, IDIs and KIIs included in this analysis.

Table 1. Qualitative method, description and number used in analysis

	Focus Group Discussions	In-Depth Interviews	Key Informant Interviews
CCPF Users (female)	4	4	0
Non-users familiar with CCPF (female)	4	4	0
Community volunteers	0	0	8
Total	**8**	**8**	**8**

Data Analysis

Summary statistics on the number of calls, type of caller, and tips and reminders messages received were analyzed in Access 2013. Translated transcripts, from the evaluation, were coded in Nvivo 10. Codes deemed relevant to the research aim were chosen in advance and new codes were added as themes emerged in the transcripts. The final codes fell under the following themes: catalysts to accessing CCPF, access preferences, reasons for using CCPF, point of CCPF interaction, and perception of interaction with CCPF, structural barriers to accessing CCPF, personal barriers to accessing CCPF, reasons for not using CCPF, misconceptions about CCPF, volunteer motivation, volunteer demotivation, and volunteer descriptions of CCPF.

Since this was a secondary review of the qualitative data collected as part of a larger study, the study aim was not articulated during the design of the evaluation. As a result, there are likely other perspectives or themes which would have surfaced had this study been incorporated into the primary research questions.

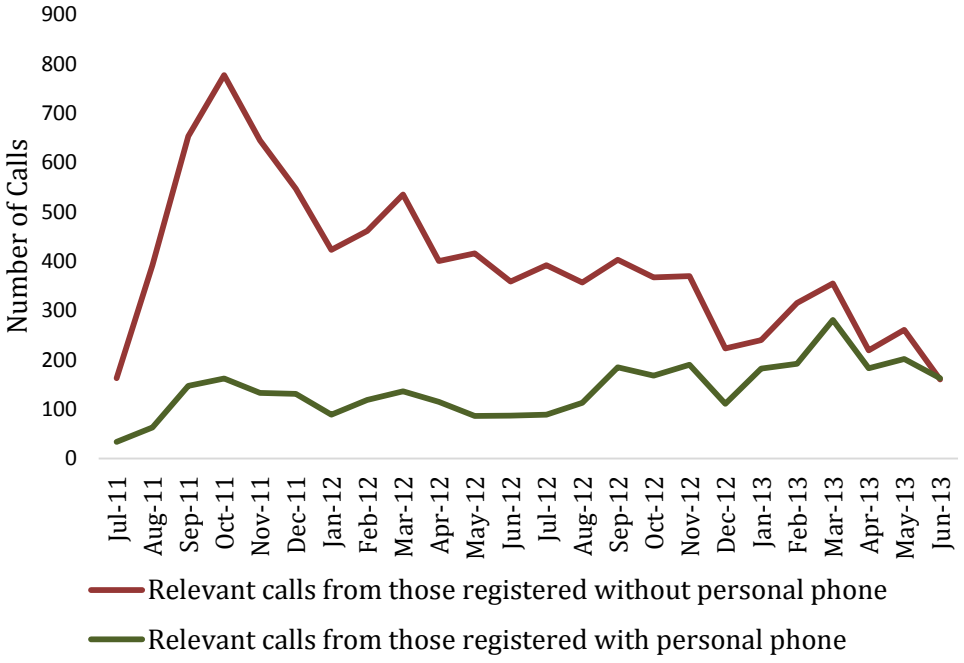
Results

Utilization of CCPF

During the two-year pilot (July 2011 through June 2013), CCPF received 12,794 relevant calls from 9,328 unique users. Of these relevant calls, 9,433 (74%) came from callers registered without personal phones and 3,361 (26%) came from callers registered with personal phones. However, when looking at call trends over time, the number of calls from callers registered without personal phones decreased while calls from callers registered with personal phones increased (see Figure 1). The last month of the pilot (June 2013) was the first month where calls from those with personal phones

outnumbered calls from those without. This trend continued post-pilot with 62% of calls coming from users with personal phones during the first 12 months following the pilot.

Figure 1. Call Volume by Type of Phone Registered (July 2011 to June 2013)



During the two-year pilot (July 2011 through June 2013), 5,884 people signed up for the tips and reminders mobile messaging service. Of those, 3,799 (65%) registered without personal phones. A total of 27,620 messages were successfully played from the IVR which is approximately a third (31%) of the number of messages that should have been played if each user listened to every available message during the time they were enrolled. However, due to the high proportion of enrollees without personal phones, almost half of the tips and reminders messages that successfully reach clients during the pilot were messages retrieved through the IVR (48%).

In interviews and focus groups, users and volunteers spoke of a number of benefits and limitations to accessing CCPF through volunteers. These benefits and limitations have been categorized into themes and are discussed in the following paragraphs.

Benefits

Increased Access through Volunteers with Phones

Many users relied on the volunteer and their phones for access to the CCPF service. This corroborates hotline usage

data that shows that most users of CCPF over the life of the pilot were people registered without personal phones. As one user put it "Some of us we don't have phones [or] radios. We are just people. We rely on the volunteer." (CCPF user, FGD participant).

In many cases, volunteers' roles as promoters of CCPF and phone access providers were closely intertwined. The following volunteer describes promoting CCPF to women gathered at a borehole to collect water by also informing them of the availability of a project phone:

"I could go there and ask 'women, have you ever heard of the CCPF?' So they could say 'no we don't know, since we don't have a phone in this village.' So I could say 'mmm, the phone is available. We were given freely by the government. The advantage is that when you call, whatever you are going to be told you will have an interest that you will be able to tell others.' So they were having an interest that, 'it is like that? Let me try to call.' So I have been chatting with many groups." (volunteer, KII participant).

Increased Support through Volunteers with Phones

In addition to serving as access points, volunteers were important in generating demand for CCPF and supporting users in accessing the service. Most users described interactions with volunteers positively, complimenting the volunteer for being helpful, respectful and confidential. The following user described her experience with a volunteer: "He treats us well. When I was pregnant the volunteer visited me to tell me about *Chipatala cha pa Foni* and when I registered I found out that it is really beneficial." (CCPF user, FGD participant).

Some users described receiving help accessing CCPF on their own phones from a volunteer even though they had access to a personal phone. For example, the following user describes a volunteer helping her register for the tips and reminders mobile messaging service: "The volunteer told me that it is possible to receive tips and reminders on your phone. He took my number and entered it in that phone, the free one. He sent my number and I started receiving tips and reminders." (CCPF user, FGD participant).

Limitations

Difficulty Accessing Volunteers

When asked about the most convenient way to access CCPF, the majority of users stated that a personal phone was more convenient than visiting a volunteer but visiting the volunteer was the only feasible option for those who didn't own phones. Users complained about the inconvenience of having to travel to find the volunteer. Many users talked about volunteers living far from their own residence. One focus group participant describes being unable to visit the volunteer during the rainy season because they lived on opposite sides of a river: "There is a river, so for us to cross if the river is full, is not easy…when I was pregnant the river was full. I failed to go call *Chipatala cha pa Foni*." (CCPF user, FGD participant).

Some individuals who had heard of CCPF but never used it, cited long distances to the volunteer as a reason for not using the service. This focus group participant, for example,

describes taking a sick child directly to the health center rather than visiting the volunteer: "I rushed the child to the health center because of the child's condition was very bad. I felt that fetching the volunteer to use the CCPF could lead to delays, so I took the child to the health centre to have my child diagnosed and assisted in good time." (Non-user, FGD participant).

Volunteer Motivation

While users described volunteers positively, the volunteers themselves mentioned that they and their colleagues became less motivated over time. Many volunteers stated being disappointed that they received little financial incentive for their participation. For example, the following volunteer describes being disappointed to learn that volunteers were given only 500 Malawi Kwacha (the equivalent of USD $3.33 in July 2011) and a snack at monthly volunteer meetings: "We were expecting that with the job we are given, we will be bosses. But when we reached [the monthly meeting], we were only given Fanta and K500.00. So it was not varying [and we complained], 'the job is painful, when there is no energy to charge the phone for the whole month with only K500.00. How are we going to keep it, and even charging the phone is for K50.00 here.' [VillageReach] said, 'you are just volunteers.' So many people stopped working, those who are remaining are just few….So we have dropped from 60 [volunteers] to 40." (Volunteer, KII participant).

Another volunteer described learning that a fellow volunteer had quit: "She stayed for two months without going to submit reports so when I asked her she told me that she stopped because there is no benefits and its better she find something to do to earn a living. So I was like 'okay.' And I heard that she even sold her phone." (Volunteer, KII participant).

Some volunteers, however, stated that they never expected incentives and were motivated by wanting to help their community. The following volunteer explains why they were motivated to work for CCPF during a key informant interview: "What motivates me is that I see that if I don't work hard it means am breaking someone's life in this [village]. I see that not everything is for money. It's free to help the people in the village, because for the development to come it's because of us the people, because if we become lazy the development cannot come." (Volunteer, KII participant).

Phone Maintenance and Charging

Volunteers also faced a number of challenges trying to maintain phone availability. Volunteers were given low-cost phones at the beginning of the pilot; by the end of the pilot, over 70% of those phones were broken. A number of users spoke about the inability to access CCPF because the phones were not working. It was the volunteers themselves, however, who most frequently brought up the fact that many of the phones broke over time. Quotes from volunteers show that without the phones, many volunteers felt they could not properly perform their duties as CCPF volunteers:

"The phones were not long lasting, it was not fully functioning, and we were trying to work hard but we could not because of the phones." (Volunteer, KII participant).

"People do come to say 'my son is sick' but we could say, 'the phone is broken.'" (Volunteer, KII participant).

In interviews, volunteers frequently brought up the fact that they were expected to share solar panels with other volunteers, which posed a challenge due to the distance between volunteers. In addition, like the phones, the solar panels broke with time. Some users cited examples of trying to access CCPF through a volunteer only to find that the phone had a flat battery. But like the issue of phones breaking, it was the volunteers themselves that were most likely to speak on the challenges of keeping the phones charged:

"[VillageReach] gave us the [solar charger] but with the way we are here, we are far apart. They were giving one solar [charger] to five volunteers. So here I am all alone the others are at [another village]. So to leave here and charge at [the other village], I was seeing it as not possible. And again, the solar did not work for a long time. They are damaged." (Volunteer, KII participant).

"We did not have the chargers. We could charge on ourselves using our own money and there was nothing that [VillageReach] were helping us [with]. When we talk to [VillageReach] they could say we will give you solar panels. They could give us solar but it could function for a month and then it is damaged." (Volunteer, KII participant).

Despite challenges, a number of volunteers talked about continuing to work for CCPF without the project phones, either by offering their own phones to users or by borrowing phones for users to use:

"We borrow because [VillageReach] told us that we can use any other phone. So I borrow my mother's phone." (Volunteer, KII participant).

"Because sometimes [users] find that there is no power in the phone [flat battery]. So when [users] really want to call, I give them my phone." (Volunteer, KII participant).

Difficulty Understanding How to Access the IVR

Volunteers were trained on how to access the IVR and were supposed to help users access the IVR. In interviews, some volunteers described how to access the IVR to help users listen to their messages. These volunteers seemed to have no problem using the system:

"The voice recording says that 'If you want tips and reminders for pregnant women press 1' then you press that number. Then you are told to enter the identity number; the expected date of delivery. Then you enter the expected date of delivery that you were given; it should have only six digits…" (Volunteer, KII participant).

Other volunteers, however, described struggling to access messages or observing their colleagues struggle to successfully retrieve messages. For example, the following volunteer describes being unclear how to access tips and reminders from the IVR:

"On the tips and reminders, both in text and audio form, I had problems in the first place since I was failing to differentiate them. For instance a client

may ask about audio tips and reminders. In my understanding such tips and reminders are very difficult compared to those in text form. This is the case as it is an easy thing for [SMS] tips and reminders to be sent into your phone. Then you can read it. For the audio tips and reminders requires that a person has to do some dialing. Frankly speaking, tips and reminders in the form of audio did not reach the registered clients." (Volunteer, KII participant).

Several volunteers noted that the training they received was not adequate to learn how to use the IVR:

"Most of the volunteers in this area were facing problems with [the IVR]. We were failing to do it because of limited time for [training]. What was happening was that you were being told to enter a number then upon entering it you find that you have missed it. In this case you have to start all over." (Volunteer, KII participant).

"[VillageReach was] lucky that some of us know how to operate the phones to the extent that we were also assisting those volunteers who were facing challenges…There were many challenges in the early stages of the project since many people were punching in wrong figures. Then they were being told [by the IVR] to ask the volunteer. Unfortunately this was happening to the volunteers themselves…'Sorry the number is wrong" then you press the numbers again then you hear 'Number not recognized, please consult your volunteer.'" (Volunteer, KII participant).

Discussion and Implications

Understanding the benefits and limitations of using intermediaries equipped with phones as access points to mHealth services is important for determining how to implement mHealth projects in areas with low phone penetration. Community volunteers and their phones were critical access points to the service for users without personal phones, especially during the start-up phase of the intervention. The majority of both hotline and the tips and reminders service users were people registered without personal phones. Qualitative data confirm that many users only had access to the service through a volunteer.

Access to the service through intermediaries does have its limitations as is clear from the results of this study. From the user perspective, having to find the volunteer – in terms of distance and time – was an inconvenience, particularly when compared to using a personal phone. While one of CCPF's goals is to extend the reach of the health system to those living in remote areas, distance and other geographical barriers still inhibited some users from being able to access the service through volunteers.

Keeping phones and solar panels charged and in working order presented significant challenges over time. By the end of the pilot, more than 70% of the volunteer phones no longer worked. The logistical and financial inputs required to maintain and/or repair phones present a threat to the sustainability of mHealth projects that rely on distributed phones. For example, an mHealth project in Rwanda known as Rapid SMS also reported challenges with phone maintenance and phone charging after equipping community health

workers with mobile phones for the project (Ngabo et al. 2012). In order for intermediaries to be a sustainable and consistent way to ensure access to mHealth services in low-phone ownership environments, implementers will likely need to invest more resources in repairing and replacing phones.

Despite some effort to motivate volunteers, volunteer motivation appears to have decreased with time. The volunteers were chosen by community leaders who selected individuals who were already committed to supporting health projects in the community. Furthermore, volunteers were given small incentives such as t-shirts, the community phones which they could also utilize for personal use and small amounts of monetary support at monthly meetings. A number of studies have found that health volunteers in sub-Saharan Africa are dissatisfied by working without pay (Brunie et al 2014; Gisore et al 2013; Takasugi & Lee 2012) and find small incentives, such as transport reimbursements to be inadequate compensation for their efforts (Brunie et al 2014). Money and bicycles are commonly cited by health volunteers as desired incentives for their work (Brunie et al 2014; Gisore et al 2013) though non-monetary incentives such as community recognition can also motivate volunteers (Takasugi & Lee 2012). In addition, there is research that suggests that problems beyond inadequate incentives such as lack of collaboration with peers or inconsistent access to supplies needed to perform volunteer duties can lead to demotivation (Brunie et al 2014; Takasugi & Lee 2012). For long-term use of volunteer intermediaries, more emphasis needs to be put on keeping volunteers motivated and equipped with the supplies needed to their jobs (in this case, phones).

Accessing the tips and reminders service through the IVR system was difficult for both users and the intermediaries. Interviews with volunteers showed that many felt the training they received was inadequate, particularly for those with limited experience with phones prior to the program. As a result, many volunteers were unable to assist users in retrieving messages as was originally intended. In addition to improving training, there may be ways to modify the IVR system in order to make message retrieval easier. For example, messages for women of childbearing age had the lowest retrieval rates during the pilot. After the pilot, VillageReach modified the IVR system so that once a user reaches the correct message menu, they hear a different message each week without the use of an access code. This has improved retrieval rates and works well for messages that are not designed to be specific to a stage in pregnancy or child development.

Conclusion

Improving access to mHealth projects to users without personal phones is crucial to the success and reach of future mHealth projects. While the use of volunteers as intermediaries to improve access and utilization for users without personal mobile phones during the CCPF pilot was not without limitations or challenges, the majority of users (more than 65%) registered for CCPF services without a personal phone. These users may not have been able to access the service without the assistance of a volunteer. Further research is needed to better understand

the impact of using intermediaries and phones to increase access to mHealth amongst individuals without personal phones. In particular the resources and effort needed to sustain these strategies over long periods of time should be explored.

Acknowledgements

The CCPF pilot is part of the *Innovations for Maternal, Newborn & Child Health*, an initiative of Concern Worldwide US funded by the Bill & Melinda Gates Foundation. The Government of Norway and the United Nations Foundation also supported the Malawi mHealth project (CCPF) through the Innovation Working Group Catalytic mHealth Grants program as part of the UN Secretary General's Every Women Every Child strategy. Local implementation in Malawi was led by VillageReach, in partnership with the Malawi Ministry of Health and Baobab Health Trust. We would like to give special thanks to the Reproductive Health Unit and its Director, Mrs. Fannie Kachale, and the Balaka District Health Office for their support of CCPF. We would like to acknowledge Jean Christophe Fotso and Ariel Higgins-Steele for their valuable feedback and contributions to this manuscript. We also thank the anonymous reviewers for their comments and suggestions which lead to a stronger paper.

Authors' Contributions

All authors worked together to devise the key research questions and framework for the paper. ELC and EB conducted the data analysis. ELC drafted the manuscript with contributions to the introduction from MOT. All authors contributed to revisions and have approved the final version.

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