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Does mobile phone ownership matter? Insights on engagement in mHealth and e-government interventions from Southern Africa

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ABSTRACT

The proliferation of mobile phones across the world has contributed to the rise of mHealth interventions as a complementary means for improving health outcomes in areas where health facilities are limited. However, community members who do not own or have access to mobile devices feel excluded from such interventions. In this paper, we seek to understand and explore engagement strategies that support the inclusion of non-mobile phone owners in mHealth interventions. We conducted a review of mHealth and community engagement literature to gauge the strategies different studies have employed to engage non-mobile phone owners and users. We further reflected on two Southern African case studies from health and citizen engagement sectors to gain insights on ways non-mobile phone owners may feel included in mHealth interventions. Through a process of thematic analysis, we have identified three areas that mHealth implementers could draw from when designing more inclusive mHealth interventions. These strategies include the need for sensitising communities, using multi-stakeholder and multi-sectoral collaboration, and embracing a braided approach to communication technologies. We hope that this paper will inform mHealth project implementers on different strategies they can use to include community members, regardless of whether they own mobile phones or not.

Introduction

Globally, mobile phone penetration rate sits at 68%, while that of the African continent is at 82% (Kemp 2018). Mobile phone penetration rate is defined as the number of Subscriber Identification Module (SIM) cards in a country (Mai 2019). This high spread of mobile phones has led to the development of mobile applications used in different sectors of society, in low-income countries, for social and economic development (Burjorjee and Bin-Humam

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2018; Labrique et al. 2017). One such sector is the health sector which has seen a surge in mobile health (mHealth) initiatives around the world to bridge the gap between health service providers and hard-to-reach communities. mHealth is a medical and public health practice supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistants (PDAs) and other wireless devices (WHO 2011). Despite this development, people in low-resourced settings in low-income countries, especially women, are often unable to harness mobile phones to enhance their social and economic wellbeing (Gillwald, Mothobi, and Rademan 2018). Many individuals and households do not own mobile phones for internet and general use (Mothobi and Gillwald 2018). More broadly, Africa has been experiencing uneven mobile phone penetration, with South Africa having the highest penetration rate at 85% as compared to Mozambique at 40%. Hence, mobile phone ownership can affect mobile interventions and considerations need to be made when conceptualising, organising, and implementing interventions which use mobile phones (Tran et al. 2015).

Several challenges affect community participation in mHealth interventions, such as mobile phone ownership, battery life, literacy, and cultural factors (Hoque and Sorwar 2017; Lund et al. 2012). Research has shown that community members who do not have a mobile phone feel excluded from participation in society (Raj, Kumar, and Kumar 2020; Haindorfer 2017). Social exclusion is the disadvantage encountered by particular groups who feel they are removed from mainstream society, and who cannot fully participate in different interventions (O'Donnell, O'Donovan, and Elmusharaf 2018). Hence, limited mobile phone ownership may lead to poor community engagement or no participation in mobile interventions by people in low-resource settings (Haindorfer 2017).

Social inclusion, which is central to policy and practice, has been a concept under discussion over the years, with the main focus being its significance in health (O'Donnell, O'Donovan, and Elmusharaf 2018; Das et al. 2017). Since the ownership of a mobile device influences participation in mHealth (Uddin et al. 2017; Hampshire et al. 2015), it is paramount that the design of mHealth interventions should be inclusive of community members who do not own mobile phones (Merwe and Grobbelaar 2018). We argue that there are different ways of including community members who do not own mobile phones to participate in mHealth interventions. However, the literature on ways to engage non-mobile phone owners in mHealth projects is limited. Therefore, we draw from diverse domains and seek to explore the strategies and activities that facilitate the inclusion of non-mobile phone owners in mHealth-development interventions.

In this study, we analysed mobile intervention literature, through the modified spectrum of public participation lens, to identify different strategies employed in various sectors when engaging communities. We reflected specifically on two case studies from the health and e-government sectors from Southern Africa that engaged non-mobile phone owners in their interventions. Secondary data from the literature was triangulated with the two case studies to provide a better understanding of how communities can be engaged in diverse mobile-driven interventions. Moreover, learning from other sectors aided in strengthening our understanding of how community members without the prerequisite technologies can participate in mobile social change interventions. Using qualitative interpretive meta-synthesis, we then extracted strategies that would apply to the health sector and influence future designers of mHealth interventions to be more inclusive of participants who do not own mobile devices.

The modified Spectrum of Public Participation framework

In 2007 the International Association for Public Participation (IAP2) developed the Spectrum for Public Participation, with the aim of developing a consistent approach to public or community engagement, by guiding how to undertake engagement activities and the steps and processes needed to be considered (IAP2 (International Association for Public Participation) 2007). It further helped with clarifying the role of the public (community) in planning and decision making (Mirza, Vodden, and Collins 2012; Zhu 2012). There are alternative models such as Community-based Participatory Research (CBPR), an approach to research that involves community members and other stakeholders to increase knowledge and understanding about a phenomenon, and to incorporate knowledge gained with interventions for policy and social change benefiting the community members (Tremblay et al. 2018). Other frameworks such as ExpandNet are also used to inform project implementers on how they can scale-up interventions (Chandra-Mouli et al. 2015). However, these models were not fit to inform this study because they could not elaborate on how to engage community members at each stage of the intervention.

Researchers have used the modified spectrum of public participation to understand the process of community engagement (Davis et al. 2018; Cyril et al. 2015; O'Mara-Eves et al. 2013) and used it to develop further models on community engagement (Zhu 2012; Lavery et al. 2010). Nabatchi (2012) argued that public participation could employ different modes of communication and she later revised the Spectrum of Public Participation. Figure 1 illustrates the Modified Spectrum of Public Participation and the levels of engaging communities.

Inform

Inform is considered the most basic level of engagement. Various media and methods can be used to inform the community about a program or interventions, which is essential. Means of communication may include websites, social media, television, newspapers, fact sheets, and radio (Hume City Council 2013; Mirza, Vodden, and Collins 2012). However, information sessions should also be organised in the community so that individuals who are unable to access digital or print media are informed as well (Hume City Council 2013). Language is another vital aspect to be considered when reaching out to the community and implementing mHealth interventions (IDRC (International Development Research Centre) 2018; Chib, Velthoven, and Car 2015; Tindana et al. 2011).

Consult, Involve, and Collaborate

Researchers have argued that consult, involve, and collaborate are the same thing, but may differ in the degree of engagement (Mirza, Vodden, and Collins 2012; Nabatchi 2012). Participation at these levels ranges from information-sharing to formal consultations on proposals, through various types of partnerships and delegated powers (Head 2007).
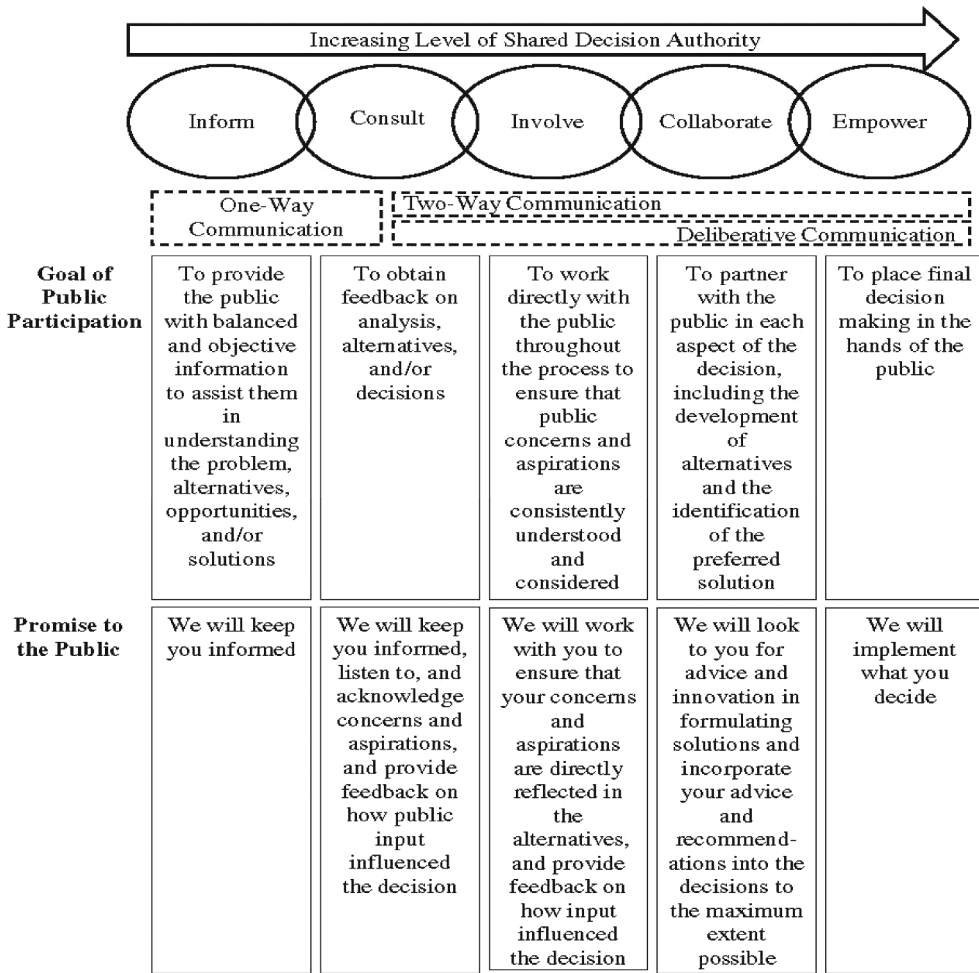
Figure 1. The 'Spectrum for Public Participation' developed by the International Association for Public Participation (IAP2 2007) and revised by Nabatchi (2012)

Empower

Researchers have argued that stress on citizen control has a risk of capturing popular opinion without considering the involvement of disadvantaged citizens (Tritter and McCallum 2006; Hayward, Simpson, and Wood 2004). Empowering is a method rather than a hierarchical stage in the community engagement process (Kilpatrick 2009). It is through empowerment that communities gain control over their lives and change their social and political environment to improve their health and quality of life (Wallerstein 1992).

The Spectrum is not a flowchart, and the levels are not steps in a process (IAP2 2007). If issues are not complicated, lower levels can be more appropriate than higher (IAP2 2007). However, project implementers can negotiate the choice of different levels of engagement, and communities can challenge the level of engagement (Hardy 2015).

Materials and Methods

This study employed a qualitative interpretive meta-synthesis to synthesise data from secondary sources and two case studies. Even though there are different methods for synthesising qualitative data such as meta-ethnography or cross-case analysis, these methods are lacking in providing guidance on sampling or inclusion criteria (Aguirre and Bolton 2014). Qualitative interpretive meta-synthesis is used to synthesise studies and each study is turned into an individual phenomenon, where all the studies are combined to provide a new, in-depth, comprehensive understanding about the phenomenon under investigation (Keyes, Crutchfield, and Tonui 2020; Aguirre and Bolton 2014). Furthermore, qualitative interpretive meta-synthesis is an iterative approach which focuses on development of concepts or theory generation (Dixon-Woods et al. 2006).

A deductive theoretical approach was used to understand the process of community engagement. We synthesised the findings to identify themes around mobile phone engagement within individual studies and to cross-reference with other studies from literature (Aguirre and Bolton 2014).

Data collection and analysis

In our study, we relied on secondary data from the literature to identify the inclusion strategies that mobile phone interventions employed when engaging non-mobile phone owners. We employed purposive and theoretical sampling methods to search case studies and secondary data. Using purposive sampling we identified two case studies – MobiSAM (The Mobile Social Accountability Monitor) and Chipatala Cha Pa Foni (CCPF) – which means Health Centre by Phone. We had access to experiential data that provided insights for this work. Both studies have empirically embraced a multi-strategy approach to account for members of the community who could not participate in their interventions due to lack of a mobile phone.

Drawing insights from the two case studies in low-resource settings and from two different sectors (e-government and mHealth) helped us in understanding the ways in which to proactively engage community members where mobile device ownership is a barrier to participation and engagement. Despite the different sectors, both case studies demonstrated similar strategies that benefited non-mobile phone owners, which we could triangulate and draw lessons from (Lincoln and Guba 1985). Using the case study descriptions and the context and setting used in this study, the strategies drawn from the two case studies have the potential to be applied in different sectors in low-resource settings. Transferability of qualitative research results is important to ensure trustworthiness of a study (Cypress 2017). Furthermore, we purposively searched peer-reviewed research papers, conference proceedings, literature reviews, and doctoral theses in PubMed and Google Scholar on community engagement and mHealth. In addition, we searched for grey literature from organisational websites and agencies who were working in areas of community engagement or participation, social inclusion, and mHealth. In order to ensure trustworthiness of our study, secondary data was triangulated through different data collection methods used (interviews, focus group

discussions, and surveys) and research design traditions (case studies, design science, and surveys) in the sample (Aguirre and Bolton 2014). The following criteria guided our search in terms of including literature for analysis:

Publications that explore community engagement or participation in different interventions or programs and/or

Studies that identify means to include a marginalised community in low-income countries and low-resource communities.

We excluded studies that were merely referring to mHealth community engagement in general, without referring to the methods used to engage the community. Based on the literature that we identified, we reviewed the titles and abstracts and selected the papers that met our study inclusion criteria for full-text review. Theoretical sampling was used later in the analysis to add and elaborate on the emerging analysis. Figure 2 outlines the steps followed for inclusion and exclusion of papers. A total of twelve papers and three of grey literature went through for full-text review. Through a process of triangulating secondary data from literature and our experiences from the MobiSAM and CCPF case studies, we highlighted the opportunities for engaging non-mobile phone owners in the engagement process. The case studies represented both the health (CCPF) and citizen engagement (MobiSAM) sectors and provided a departure point for developing a
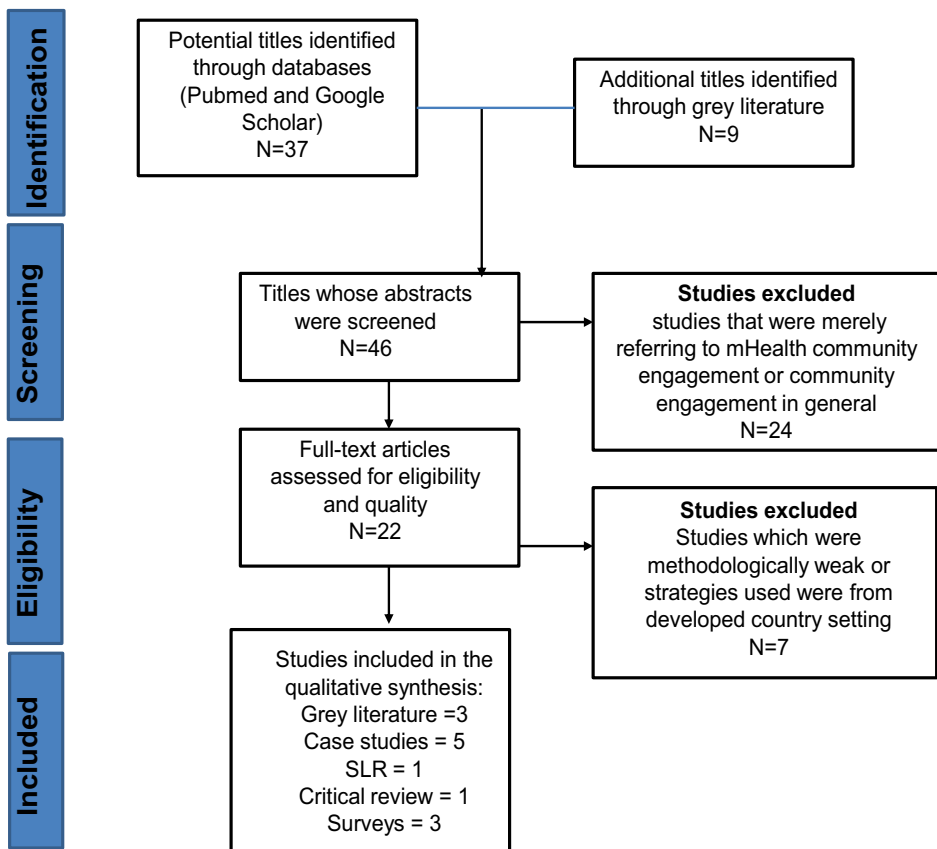

Figure 2. Steps followed for inclusion and exclusion of papers.

collection of engagement strategies from a resource-constrained setting perspective. Furthermore, although the papers reviewed reflected multiple domains, we were able to draw lessons that could be applied within the health domain. Table A1 summarises the demographic characteristic of the papers used in this study.

We used thematic analysis to organise the data using the modified spectrum of public participation. The modified spectrum of public participation provided the context on community engagement, while guiding the findings of the study. This understanding helped us to extract original themes used in the studies by authors (Aguirre and Bolton 2014), as depicted in Table 2. The original themes were then grouped into three main themes, as depicted in Table 3. This process involved iterating between themes and data (Creswell 2014).

Community engagement in MobiSAM and CCPF case studies

MobiSAM

The Mobile Social Accountability Monitor (MobiSAM) project uses mobile technology to support two-way communication on basic service delivery issues between citizens and the Makana Municipality in South Africa (Thinyane and Coulson 2012). MobiSAM sought to provide a platform for citizens and the municipality to engage and provide a means for evidence-based reporting within the community (Thinyane and Coulson 2012).

Access to a mobile device and level of civic responsibility were two factors that influenced how citizens could take part in the MobiSAM initiative (Thinyane and Siebörger 2017). Therefore, the project sought ways in which to address this on two levels:

Firstly, improving civic responsiveness by raising awareness around citizen rights and also having various citizen education campaigns;

Secondly, identifying and leveraging existing ways in which citizens engage with the municipality and within their communities.

From the baseline study, the MobiSAM team realised the required multiple channels for including citizens. These included:

Working with ward councillors, whereby citizens could report problems to their ward councillors; the ward councillor would then log the problem onto the MobiSAM platform, either via phone or via a desktop computer;

Working with community development workers and MobiSAM ward liaisons who would go around within the community (their wards specifically) to report any issues around service delivery;

Working with the community libraries whereby citizens could go to their nearest library and log onto MobiSAM to report any issues;

Working with Grahamstown radio, where listeners could call in and report any problems.

Given these various platforms, it still took time for citizens to engage with them all and for social inclusion to take effect.

Chipatala Cha Pa Foni (CCPF) – Health Centre by Phone

Chipatala Cha Pa Foni (CCPF), which means Health Centre by phone, is a free health and nutrition hotline (Blauvelt et al. 2018). The pilot phase of the intervention was launched in 2011 in a rural district in Malawi for maternal and child health. CCPF focused on pregnancy, antenatal, and postnatal areas, whereby 'Tips and Reminders' through Short Message Service (SMS) and voice messages were sent to expectant mothers and child caregivers according to the month of the pregnancy or age of the child. CCPF has now expanded to include standard health topics according to Malawi's Ministry of Health (MoH) guidelines.

The intervention provides communities with greater control and opportunity to interact with the health system without having to travel long distances to the nearest health facility. The intervention encourages members of the community to use their mobile phones or to borrow mobile phones from family members or friends. About 20% of the maternal mothers registered for CCPF use borrowed mobile phones (Blauvelt et al. 2018). During the pilot phase of the study, non-mobile phone owners used community volunteers to access the intervention. One of the challenges that the project experienced was poor participation and involvement of communities (Nyemba-Mudenda 2017). Despite the challenges, the intervention has now evolved to become a general healthcare intervention. It has been taken over by the Malawi Government through the Ministry of Health and rolled out in all districts in Malawi (Blauvelt et al. 2018).

Results

In this section we draw on the modified Spectrum of Public Participation framework as a lens to present our results on the ways in which the interventions have been engaging target populations. Across the different projects and case studies from literature, different levels of shared decision authority have been demonstrated, as outlined in the Spectrum of Public Participation framework.

Inform

Both the MobiSAM and CCPF case studies and the surveyed literature have shown that the initial phases of their projects entailed activity mainly at the inform level of interaction. During awareness campaigns, '*the project brought together local primary healthcare centres, health workers, ICT technicians, godmothers, community leaders, and public health researchers*' (IDRC (International Development Research Centre) 2018). Communities received necessary information about interventions, the purpose, and expected goals of projects. A common element across projects was that the initial stages of projects elicited buy-in from the community and raised awareness about what the project team sought to achieve.

Part of awareness-raising is the need to sensitise the community on various issues that influence the success of an intervention. For example, the 'Community engagement for better health' project in Burkina Faso sought to sensitise husbands and family members who owned mobile phones to allow women to make use of their mobile phones within the project (IDRC (International Development Research Centre) 2018). As for

MobiSAM, the first citizen awareness-raising task that MobiSAM did was to run a series of articles in Grocotts' Mail (a local newsletter) around this theme, informing citizens of their rights and responsibilities as active citizens (Thinyane and Coulson 2012).

Consult, Involve and Collaborate

In the MobiSAM case study, citizens, the municipality, and the project team worked together during the design, development, and implementation of the MobiSAM platform. The project team involved the ward councillors, the community libraries, and local radio stations, in the planning and implementation of the project to leverage existing means in which the community had been interacting. Ward councillors had access to a mobile phone, mobile data, and a laptop computer; therefore, they were in a position to log service delivery problems on behalf of their ward constituents. The public libraries agreed to have the MobiSAM instruction videos installed on the library computers and allowed citizens to use the facilities to log any service delivery problems on the MobiSAM web platform. Much like the MobiSAM and CCPF cases, other projects that we surveyed demonstrated that they worked closely with key stakeholders within communities to ensure that the development of the project was a collaborative exercise. Beyond the need to involve various stakeholders, there is also the need to make use of different communication channels in parallel to ensure different users are involved, as was the case with the reproductive health project in Uganda (Densmore et al. 2013).

Empower

From the surveyed literature, empowerment of communities was through the ability to have a voice on the implementation of projects and having access to alternative avenues (through collaborative design) for gaining the most benefit from a particular intervention. For example, for the CCPF case study, a toll-free line was implemented to overcome the issue of cost (Nyemba-Mudenda 2017).

> 'As CCPF's service will continue to expand, regular gathering of user feedback will be vital in ensuring that messages stay relevant and understood by its callers/end users from the communities' (Social Innovation in Health Initiative 2019, 1).

Discussion: Engagement strategies for non-mobile phone owners

Working alongside communities improves the likelihood that mHealth interventions are relevant to local needs, informed by local knowledge and priorities, and therefore are effective (George et al. 2015). More importantly, depending on the social processes involved, engaging a community in mHealth interventions can be transformative through a process of empowering people in low-resource settings (George et al. 2015).

The findings of this study helped us to learn how existing projects engaged communities and from these findings we then outline strategies for engaging non-mobile phone owners. We have identified three areas to consider when engaging community stakeholders in mHealth interventions with a view to being more inclusive of community members who do not own mobile devices. Table A2 illustrates the key engagement

themes identified from our source literature. Table A3 summarises and collates the themes synthesised from literature on strategies used to include non-mobile phone owners in mHealth interventions. Thus, the themes under discussion are sensitising communities, using multi-stakeholder and multi-sectoral collaboration, and embracing a braided approach to communication technologies.

Sensitising communities

In low-resource settings, there is a wide gap in mobile phone ownership between rural and urban populations (Rheault and McCarthy 2016). For example, in South Africa, 81% of an urban population own a mobile phone compared to 68% of rural population, which represents a 13% gap in mobile ownership (Rheault and McCarthy 2016). On the other hand, in Malawi 66% of the urban population own a mobile phone compared to 40% of the rural population, which represents a 26% gap in mobile phone ownership (Rheault and McCarthy 2016). The gap is even wider among women in resource-constrained settings (Burjorjee and Bin-Humam 2018). An understanding of the gender gaps in mobile phone ownership and local factors such as the cost of a mobile phone and social norms will enable mHealth intervention designers to implement more inclusive projects (Santosham 2015). Through this process of awareness building and sensitisation, specific social barriers may be lifted and may pave the way for project integration and more inclusive community member participation. For example, to make maternal mHealth interventions more inclusive, in Burkina Faso, husbands and family members were sensitised to allow women to use their mobile phones (IDRC (International Development Research Centre) 2018). The intervention also recruited and provided them with mobile phones to reach out to women who did not own mobile phones (IDRC (International Development Research Centre) 2018).

As part of the sensitisation process, a project team should build community capacity and provide support to engage in mHealth interventions fully. Limited health literacy is one component that does hinder community members from benefiting from health interventions and, therefore, should be included as one of the elements when sensitising a community on various health issues. Often project teams will work with Community Health Workers (CHW) to engage the community, provide support, and give all the necessary information that community members may need (Findley, Doctor, and Afenyadu 2016). Such stakeholders should therefore also be involved in sensitising the community about an mHealth intervention and its anticipated role within the community.

Using multi-stakeholder and multi-sectoral collaboration

Encourage multi-sectoral collaboration

Multi-sectoral collaboration is an enabler to scaling up mHealth interventions (Blauvelt et al. 2018; Seebregts et al. 2018). Within the broader digital health space, the term 'pilotitis' has become common as a result of the limitations to scaling (Huang, Blaschke, and Lucas 2017). This term means the act of continuously pursuing small healthcare projects but never scaling them, leading to duplications and short lived benefits (Fanta and Pretorius 2018). Ideally, mHealth interventions serve communities at the last mile –

(the most remote communities). If mHealth interventions are not scaled up, then other members of the society are excluded from accessing the interventions. Therefore, all stakeholders from different sectors should have a joint vision for government ownership (Blauvelt et al. 2018; Seebregts et al. 2018; Ngabo et al. 2012), as the government is the primary provider of public health services. CCPF was able to scale up because stakeholders prioritised the role of government from the beginning, identifying champions and building trust and, above all, reflecting on government priorities (Blauvelt et al. 2018; Ngabo et al. 2012). Several mHealth interventions in Africa have benefited from multisectoral collaboration which helped them to scale-up, for example, MomConnect, RapidSMS and CCPF (Blauvelt et al. 2018; Seebregts et al. 2018; Ngabo et al. 2012).

Leveraging existing modes of engagement

Beyond the need to leverage multi-stakeholder and multi-sectoral collaboration, there is a need to use local modes of engagement. When seeking entry into unfamiliar traditional settings, organisations, researchers, or agencies may be unsure about how to proceed or what approaches are most likely to be perceived as respectful and constructive by the community (Tindana et al. 2011). Through interacting with a community, researchers can uncover rules and social conventions. Tied to that is an understanding of existing engagement strategies that the community itself employs. This may require conducting a baseline survey of the existing engagement mechanisms, such as how local government communicates with citizens, or indeed whether it is through radio, social media, committees, councillors, chiefs etc. For example in Malawi, maternal health policies are implemented at a community level involving village chiefs using a practical approach handed down from the national level (Walsh et al. 2018). Village chiefs play an important role in mobilising community members in maternal health campaigns (Walsh et al. 2018). Hence, mHealth implementers need to be cognisant of existing structures of engagement and leverage these to reach more people and engage people in a way that they understand. mHealth projects may require being flexible to integrate multiple modes of interaction, involve various stakeholders at different levels, and include traditional and non-traditional means of sharing information.

Embracing a braided approach to communication technologies

Use different communication technologies

The use of multiple channels of communication that reinforce each other to achieve better interaction is useful within the mHealth context. Densmore et al. (2013) refer to such multiple channels as braided communications. Relying only on one channel increases the risk of excluding community members who are unable to utilise that means of interaction. By employing multiple communication channels, there are more and alternative opportunities for engagement. Various channels should include both digital and non-digital modes of communication and be tailored to the community context. For reliable communication, mHealth designers should design for multiple channels, which are reinforcing, co-existing, and co-evolving (Densmore et al. 2013). Through a process of reinforcement, the strengths of specific channels may compensate for the weaknesses of other channels. Community interaction is not static, and therefore

the implementation of mHealth interventions should be flexible enough, allow communication channels to co-evolve, as well as continue adapting to the context of the intervention (Densmore et al. 2013).

Involving intermediaries

The sharing of goods and services is not a new concept in low-resource settings (James 2011). It is usually rooted in community culture, especially in low-resource settings (James 2011). In low-resource settings, access to a mobile phone can either be through owning one's own mobile phone, sharing a phone, or using a mobile phone that belongs to someone else (Roessler 2018; Blauvelt et al. 2018). Several studies make use of intermediaries as a means of leveraging mobile phone-sharing activities to ensure that more members of a community can participate in an mHealth intervention. CHWs, family members, and friends play useful roles as intermediaries (Nyemba-Mudenda 2017; DeRenzi et al. 2016; Ngabo et al. 2012). Therefore, mHealth implementers should design for intermediation within their projects and consider the various implications.

Conclusion

Despite the increase in mobile phone ownership globally, there is a low rate of mobile phone ownership in low-resource settings. Moreover, shared mobile phone is a norm in such settings. Consequently, communities from low-resource contexts face the risk of being excluded from mHealth interventions that seek to support them. The findings of this study suggest that using multiple engagement strategies and accounting for those who do not own mobile phones reduce the risk of exclusion. This may eliminate the need for every member of a community to own a mobile phone in order to participate in an mHealth intervention. In light of this, mHealth interventions should embrace multiple strategies that account for both those who own and those who do not own a mobile phone, to actively engage in and benefit from an mHealth intervention. Embracing a collaborative approach and the use of intermediaries plays a significant role in ensuring that those who do, and those who do not own mobile phones, use mHealth interventions.

Over the years, projects are making more effort to increase the levels of engagement and decision authority by being more collaborative and aiming to empower local community members to be more active in their health processes. However, there are not many activities happening at the empower level of engagement. Moreover, moving higher up the spectrum towards collaboration and empowerment, the more resources and time are required to experience those levels of engagement.

Involving communities in deciding how interventions are delivered is more likely to lead such communities to using and responding positively to mHealth services. This contributes to local knowledge, inclusion, and more sustainable mHealth interventions. Communities have individual and collective resources (such as mobile phones) to contribute to activities for health improvement in their communities. mHealth implementers should therefore identify how they can complement such efforts and learn from successful community interventions programs that use multiple engagement strategies. Furthermore, policy makers may enforce these strategies in mHealth policies to ensure inclusiveness of all community members in mHealth interventions.

There are several complex issues in low-resource settings that need to be considered when implementing interventions while using community engagement or participation. By acknowledging the various forces that inhibit engagement in mHealth, such as mobile phone ownership, as well as understanding the cultural and social norms of a community, we are in a better position to design mHealth interventions that are more inclusive and could potentially strengthen engagement.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix A

Table 1. Summary of papers and grey literature for analysis.

	Authors and year	Title	Data collection method	Sample	Research design tradition	Context
1	Tindana et al. (2011)	Aligning community engagement with traditional authority structures in global health research: A case study from northern Ghana	20 in-depth interviews 10 focus group discussions	Paramount chiefs, Chiefs, men & women	Case study	Community engagement in traditional authority structure
2	Densmore et al. (2013)	The evolving braid: How an organization in Uganda achieved reliable communications	Participants observation	NGO, health service providers	Ethnographic action research	NGO-beneficiary communication
3	Findley, Doctor, and Afenyadu (2016)	Impact of alternative community engagement strategies on improved maternal and child health behaviors and outcomes among the most vulnerable in northern Nigeria	Survey	Married women delivered within 5 yrs	Survey	Community engagement strategies for vulnerable mothers
4	Blauvelt et al. (2018)	Scaling up a health and nutrition hotline in Malawi: The benefits of multi-sectoral collaboration	Interviews & surveys	CCPF clients	Case study	Multi-sectoral collaboration towards scale-up of intervention
5	James (2011)	Sharing mobile phones in developing countries: Implications for the digital divide	Survey		quantitative	Shared mobile phone ownership
6	Seebregts et al. (2018)	Designing for scale: Optimising the health information system architecture for mobile maternal health messaging in South Africa			Case study	Multi-sectoral collaboration towards scale-up of intervention
7	Nyemba-Mudenda (2017)	A pathway through which mHealth outcomes are produced for maternal healthcare consumers in a developing country	Semi-structured interviews	Maternal clients	Case study	Infomediaries for community engagement
8	Kenny, et al., 2015)	Community participation for rural health: A review of challenges	Critical literature review			Community participation
9	Ngabo et al. (2012)	Designing and implementing an innovative SMS-based alert system (RapidSMS-MCH) to monitor pregnancy and reduce maternal and child deaths in Rwanda			Case study	Multi-sectoral collaboration towards implementation of intervention
10	Tran et al. (2015)	Analyzing the mobile "Digital Divide": Changing determinants of household phone ownership over time in rural Bangladesh	Survey	Pregnant women	Quantitative	Household phone ownership

Table 1. (Continued).

Authors and year	Title	Data collection method	Sample	Research design tradition	Context
11 Thinyane and Siebörger (2017)	MobiSAM: Reflections from a four year case study using technology to increase participation in local government in South Africa		Citizens, municipality, radio stations	Community based co-design approach	Multi-sectoral collaboration towards implementation and scale up (of e-government)
12 O'Mara-Eves et al. (2013)	Community engagement to reduce inequalities in health: a systematic review, meta-analysis and economic analysis	Systematic literature review using meta-analysis			Community engagement
13 IDRC (International Development Research Centre) (2018)	Community engagement for better health in Burkina Faso	Grey literature		Case study	Community engagement
14 Schwartz, et al., 2014)	Optimizing mobile deployments.	Semi-structured interviews		Case study	NGO-issued mobile devices
15 Social Innovation in Health Initiative (2019)	Chipatala Cha Pa Foni: Health Centre by Phone	Grey literature		Case Study	Community engagement

Table 2. Original themes extracted from the studies.

Authors	Original themes
Tindana et al. (2011)	(1) Involving community leaders during community awareness campaigns
Densmore et al. (2013)	(1) Using different communication technologies for communication (2) Using different communication channels to sensitise citizen
Findley, Doctor, and Afenyadu (2016)	(1) Perform outreach activities targeting socially excluded
Blauvelt et al. (2018)	(1) Involve a lot of stakeholder in the intervention (2) Prioritise government involvement in the intervention in order to scale up projects (3) Involve community leader in sensitising the community (4) Use community volunteers to provide access to mobile phones (5) Users should be able to use a basic phone and provide the intervention for free
James (2011)	(1) Leverage on household phone sharing, as well as friends and relatives
Seebregts et al. (2018)	(1) Plan interventions as nationally scalable and extensible initiative (2) Design systems which are inclusive with other partners (3) Interventions should use a simple phone so that anyone with access to a mobile phone can use it and should be available free of charge
Nyemba-Mudenda (2017)	(1) Non-mobile phone owners were using community phones
Kenny et al., (2015)	(1) All stakeholders should have a shared understanding of the purpose and rationale (2) Community 'champions'/key community leaders are useful to engage in planning and implementing a solid governance environment
Ngabo et al. (2012)	(1) CHWs registered maternal clients on MCH intervention regardless whether they have a mobile phone or not. (2) The system was developed for the government
Tran et al. (2015)	(1) Promote household phone ownership
Thinyane and Siebörger (2017)	(1) Education and awareness raising campaigns about the project to municipality and citizens (2) Co-design approach to get community involved (3) Community Development workers were trained on how to use the system and register users on the system and log service delivery issues on behalf of citizen without mobile phones (4) Citizens without mobile phones were using the municipality library to log faults
IDRC (International Development Research Centre) 2018	(1) Promoted education and communication at all level: in the home, between spouses, in the village, in health centres and community associations (2) The system was available in five languages IDRC (International Development Research Centre) 2018 (3) Sensitised husbands and other family members to allow wives/mothers to use their mobile phones, godmother (were given mobile phones and bicycles) acted as intermediary between pregnant mothers and the mHealth intervention/health worker IDRC (International Development Research Centre) 2018
(Social Innovation in Health Initiative 2019)	(1) Promotion of the intervention using multiple channels (Social Innovation in Health Initiative 2019) (2) Regular gathering of user feedback in order to make the intervention more relevant (Social Innovation in Health Initiative 2019)
O'Mara-Eves et al. (2013)	(1) Draw knowledge from the community to build better intervention for a community (2) Partnership with local stakeholders and experts in the field of the issue to ensure empowerment of the community (3) Respecting cultural and religious beliefs is important when engaging communities

Table 3. Synthesized themes.

New overarching themes	Extracted original themes, author and year of publication
Sensitising communities	Using different communication channels to sensitise citizen (Densmore et al. 2013)
	Perform outreach activities targeting socially excluded (Findley, Doctor, and Afenyadu 2016)
	Involve community leader in sensitising the community (Blauvelt et al. 2018)
	Community 'champions'/key community leaders are useful to engage in planning and implementing a solid governance environment (Kenny et al., 2015)
	Education and awareness raising campaigns about the project to municipality and citizens (Thinyane and Siebörger 2017)
	Co-design approach to get community involved (Thinyane and Siebörger 2017)
	Draw knowledge from the community to build better intervention for a community (O'Mara-Eves et al. 2013)
	Promoted education and communication at all level: in the home, between spouses, in the village, in health centres and community associations IDRC (International Development Research Centre) 2018
	Promotion of the intervention using multiple channels (Social Innovation in Health Initiative 2019)
Using multi-stakeholder and multi-sectoral collaboration	**Sub-theme: Encourage multi-sectoral collaboration**
	Involve multiple stakeholders in the intervention (Blauvelt et al. 2018)
	Prioritise government involvement in the intervention in order to scale up projects (Blauvelt et al. 2018)
	Plan interventions as nationally scalable and extensible initiative (Seebregts et al. 2018)
	Design systems which are inclusive with other partners (Seebregts et al. 2018)
	All stakeholders should have a shared understanding of the purpose and rationale (Kenny et al., 2015)
	The system was developed for the government (Ngabo et al. 2012)
	Partnership with local stakeholders and experts in the field of the issue will ensure empowerment of the community(O'Mara-Eves et al. 2013).
	Sub-theme: Leveraging existing modes of engagement
	Respecting cultural and religious beliefs is important when engaging communities (O'Mara-Eves et al. 2013)
	Involving community leaders during community awareness campaigns (Tindana et al. 2011)
	The system was available in five languages IDRC (International Development Research Centre) 2018
	Regular gathering of user feedback in order to make the intervention more relevant (Social Innovation in Health Initiative 2019).

Table 3. (Continued).

New overarching themes	Extracted original themes, author and year of publication
Embracing a braided approach to communication technologies	**Sub-Theme: Use different communication technologies**
	Using different communication technologies for communication (Densmore et al. 2013)
	Users should be able to use a basic phone and provide the intervention for free (Blauvelt et al. 2018)
	Interventions should use a simple phone so that anyone with access to a mobile phone can use it and should be available free of charge (Seebregts et al. 2018)
	Promotion of feature phones for CHWs (Schwartz et al., 2014)
	Citizen without mobile phones were using the municipality library and CDW to log faults (Thinyane and Siebörger 2017)
	Sub-theme: Involving intermediaries
	Use community volunteers to provide access to mobile phones (Blauvelt et al. 2018)
	Leverage on household phone sharing, as well as friends and relatives (James 2011)
	Non-mobile phone owners were using community phones (Nyemba-Mudenda 2017)
	CHWs registered maternal clients on MCH intervention regardless whether they have a mobile phone or not. (Ngabo et al. 2012)
	Promote household phone ownership (Tran et al. 2015)
	Community Development Workers (CDW) were trained on how to use the system and register users on the system (Thinyane and Siebörger 2017)
	Sensitised husbands and other family members to allow wives/mothers to use their mobile phones, godmother (were given mobile phones and bicycles) acted as intermediary between pregnant mothers and the mHealth intervention/health worker IDRC (International Development Research Centre) 2018