

Formalising 'informal' mHealth in Ghana: Opportunities and challenges for Universal Health Coverage (UHC)

Simon Mariwah , Albert Machistey Abane , Samuel Asiedu Owusu , Adetayo Kasim , Elsbeth Robson , Michele Castelli & Kate Hampshire

To cite this article: Simon Mariwah , Albert Machistey Abane , Samuel Asiedu Owusu , Adetayo Kasim , Elsbeth Robson , Michele Castelli & Kate Hampshire (2021): Formalising 'informal' mHealth in Ghana: Opportunities and challenges for Universal Health Coverage (UHC), Global Public Health, DOI: [10.1080/17441692.2021.1874467](https://doi.org/10.1080/17441692.2021.1874467)

To link to this article: <https://doi.org/10.1080/17441692.2021.1874467>



© 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 24 Jan 2021.



Submit your article to this journal [↗](#)



Article views: 258





View related articles [↗](#)



View Crossmark data [↗](#)

Formalising ‘informal’ mHealth in Ghana: Opportunities and challenges for Universal Health Coverage (UHC)

Simon Mariwah ^a, Albert Machistey Abane^a, Samuel Asiedu Owusu^b, Adetayo Kasim ^c, Elsbeth Robson ^d, Michele Castelli^e and Kate Hampshire^f

^aDepartment of Geography and Regional Planning, University of Cape Coast, Cape Coast, Ghana; ^bResearch, Innovation and Consultancy (DRIC), University of Cape Coast, Cape Coast, Ghana; ^cDurham Research Methods Centre, Durham University, UK; ^dDepartment of Geography, Environment and Earth Science, University of Hull, UK; ^eInstitute of Health and Society, Newcastle University, UK; ^fDepartment of Anthropology, Durham University, UK

ABSTRACT

While mobile phones promise to be an important tool for bridging the healthcare gaps in resource-poor areas in developing countries, scalability and sustainability of mobile phones for health (mhealth) interventions still remain a major challenge. Meanwhile, health workers are already using their own mobile phones (referred to as ‘informal mhealth’) to facilitate healthcare delivery in diverse ways. Therefore, this paper explores some strategies for integrating ‘informal mHealth’ in the healthcare delivery of Ghana, by highlighting some opportunities and challenges. The study mainly employed a combination of literature review, focus group discussions and key informant interviews with community health nurses (CHNs) and other stakeholders, who were purposively selected from the three ecological zones in Ghana. The study found that, while scale-up of ‘formal mhealth’ remains challenging in Ghana, almost all CHNs in our study are using their personal mobile phones ‘informally’ to bridge healthcare gaps, thereby promoting universal health coverage. This provides opportunities for promoting (or formalising) ‘informal’ mhealth in Ghana, in spite of some practical challenges in the use of personal mobile phones that need to be addressed to ensure sustainable healthcare delivery in the country.

ARTICLE HISTORY

Received 1 May 2020

Accepted 3 January 2021



KEYWORDS

Informal mhealth; universal health coverage; mobile phones; Ghana

Introduction

Healthcare delivery in low- and middle-income countries can be challenging, especially in rural and hard-to-reach areas, with often limited healthcare resources, infrastructure and personnel (Hampshire et al., 2015; Hartzler & Wetter, 2014; Mehl & Labrique, 2014). For example, in terms of human resource capacities, estimates from the World Health Organisation (WHO) revealed a shortage of about 7.2 million healthcare workers globally; a figure expected to increase to 12.9 million globally by 2035 (The Health Worker Shortage, n.d., as cited in Agarwal et al., 2015). Even where healthcare is relatively affordable, poor road networks can inhibit timely access to healthcare (Hampshire et al., 2015; Hartzler & Wetter, 2014; Owusu & Amoako-Sakyi, 2011).

Recently, mobile phones have been touted as a means to improve healthcare delivery and support healthcare workers through (*inter alia*) communication of clinical updates, sharing of learning materials, and providing reminders (Mechael, 2009). Mobile health (mHealth) is defined by the

CONTACT Simon Mariwah  smariwah@ucc.edu.gh  Department of Geography and Regional Planning, University of Cape Coast, Cape Coast, Ghana

© 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

World Health Organization (2011) as the medical and public health practice of health services and information ‘supported by mobile technology, such as mobile phones, personal digital assistants, and other wireless devices’. In this regard, Hartzler and Wetter (2014, p. 182) have asserted that ‘mhealth presents significant opportunities for delivering interventions that facilitate disease management and health behaviour change’.

Particular attention has focused on developing countries where LeFevre et al. (2017, p. 2) have indicated that the high disease burden ‘has led to growing calls to harness the potential of mobile and wireless technology to improve health and healthcare delivery’. Subsequently, multiple mhealth interventions have been implemented across Africa in the form of short message services (SMS), phone-based reminder systems, health service reporting system, disease surveillance systems, among others (Mehl et al., 2018; Mitchell et al., 2013). Specific examples include Mobile Midwife and Client Data App in Ghana; MomConnect and Cellphones4HIV in South Africa cStock, RapidSMS, and ChildCount+ in Malawi; Intimo in Mozambique; and CommCare in Tanzania (Blaschke et al., 2009; de Tolly & Alexander, 2009; Grameen Foundation, 2012; Mehl et al., 2018; Mitchell et al., 2013; Zurovac et al., 2012).

In this regard, some noteworthy mhealth success stories have been reported in the literature. For example, in a randomised control trial, Lin et al. (2012) found SMS reminders increased attendance at a paediatric ophthalmic centre, while the Millenium Village Project’s ChildCount+ initiative in Malawi managed to register 95% of 9561 children under 5 years within three months (Blaschke et al., 2009). Other examples include a cluster randomised trial in Kenya which reported a significant improvement in management of childhood malaria by health-workers who received motivational messages compared with those who did not (Zurovac et al., 2011), and a study using a before-and-after trial in Tanzania, which reported a significant improvement in adherence to the Integrated Management of Childhood Illnesses (IMCI) treatment protocol for health-workers who received electronic decision-support tools (Mitchell et al., 2013). For community health-workers, mhealth is said to significantly reduce face-to-face contact hours and fuel costs (Mahmud et al., 2010) and improve efficiency through reduced unnecessary travel (Odendaal & Lewin, 2014).

However, despite the rapid increase in the mhealth initiatives worldwide, with reported success stories, only few have been scaled up to the national level and even fewer have been ‘institutionalised as routine practice within the Ministries of Health’ (Mehl et al., 2018, p. 1). Moreover, successes tend to be reported in terms of technical accomplishments, rather than impact on health outcomes (Huang et al., 2017). Such continual launching of micro mhealth interventions without scale-up constitutes an example of what Huang et al. (2017, p. 2) have called ‘*Pilotitis*’, as a way ‘to express the frustration of many of those in the health sector at the continuing emphasis on demonstrating successful outcomes from narrowly focused interventions targeting relatively small populations’.

Ghana’s mhealth experience reflects this wider pattern of time-limited, project-based approaches, with notable successes but serious questions remaining over scalability and sustainability (details are provided later under the section on results of the study). Meanwhile, Ghana has mobile-cellular telephone subscription rate of about 140 per every 100 inhabitants (ITU, 2019), with over 36.6 million subscribers (National Communications Authority, 2016), which presents opportunities for networking and communication through various social media platforms (Owusu, 2017). This provides a unique opportunity for scalability of mhealth initiatives in the country. In addition, a small-scale study by Hampshire et al. (2017) reported that health workers in Ghana and Malawi, especially those working at community level, were using their own mobile phones creatively and strategically as an important therapeutic resource – a phenomenon described as ‘informal mhealth’ by Hampshire et al. (2015; 2017). This is particularly welcoming as there are still large gaps in access to and utilisation of healthcare between rural and urban dwellers as well as between the rich and poor, reflecting the inadequate and unequal distribution of health infrastructure; limited access to health facilities especially by deprived communities; inequitable distribution of workers at different levels of services delivery; and inadequate staff numbers (Peprah et al., 2019).

Therefore, this current paper examines the practices of informal mhealth, and asks whether and how these practices might productively be integrated into the healthcare delivery of Ghana, with the aim of promoting Universal Health Coverage (UHC), which is a guiding principle within the United Nation's Sustainable Development Goals (SDGs) to ensure that all individuals 'receive the health services they need, of sufficient quality to be effective while at the same time ensuring that the use of these services does not expose the user to financial hardship' (United Nations, 2015). Thus, where people cannot access health facilities due to transport and other challenges (Peprah et al., 2020; 2019), mhealth may help bridge the gap by enabling CHNs to extend healthcare to those areas, thereby contributing to the achievement of universal health coverage (Mehl & Labrique, 2014).

Study context: Who are Community Health Nurses (CHNs) in Ghana?

The current structure of community health nurses (CHNs) in Ghana results from the *Navrongo Experiment*, conducted in northern Ghana in the early 1990s. The *Experiment* led to the introduction, in the early 2000s, of the Community-based Health Planning and Services (CHPS) compounds, each serving a demarcated 'CHPS zone' of (in theory) up to 5000 persons (MoH, 2016, p. 22). CHPS Compounds were supposed to be 'approved structure[s] consisting of a service delivery point and accommodation' (MoH, 2016, p. 22), staffed by resident CHNs, who were charged with providing community-based preventive and curative healthcare, with special focus on maternal, newborn and child care (MoH, 2016). CHNs in Ghana are trained by the Nurses and Midwifery Council, who are issued professional licenses: either certificates (2-year training) or diplomas (3-year training) (MoH, 2016). CHNs may undergo additional in-service training to become a Community Health Officer (CHO) for a CHPS Zone (MoH, 2016).

In 2016, to assist the work of CHNs, the National Youth Employment Authority (NYEA) engaged a number of temporary 'Community Health Workers' (CHWs): Senior High School graduates who underwent a 6-week training and were deployed at CHPS Compounds on a non-renewable two-year contract. CHWs were supposed to help CHNs/CHOs with the management of minor ailments; health education and promotion, sanitation and nutrition; and home visits, for which they received (in theory) a monthly allowance (MoH, 2014). However, the programme was formally phased out due to limited funding.

CHNs are also supported in their work by Community Health Volunteers (CHVs): community members, who receive basic training and orientation. CHVs assist with home visits; weighing/child welfare clinic; and community mobilisation for environmental, sanitation and health education. They also act as a liaison between the CHNs and the community, compiling and updating the community register (MoH, 2014).

Although much has been written about challenges faced by community health-workers in the line of their duties, the following challenges as summarised by Bogan et al. (2009; as cited in Agarwal et al., 2015, p. 1004) are instructive: '*lack of appropriate means to collect data, inadequate access to training and reference materials, poor communication with peers or supervisors to handle situations that are beyond their skills, and difficulty in scheduling household visits and follow-up appointments with patients*'. Notably, most of these challenges are applicable to the CHNs in Ghana, but could potentially be addressed, wholly or partially, through the use of mobile phones (Laar et al., 2019; Peprah et al., 2019; Peprah et al., 2020;). As we discuss below, it is precisely to overcome these kinds of challenges that CHNs in Ghana use their own mobile phones to deliver healthcare in the country. However, in so-doing, they risk bearing the associated economic, psycho-social, moral and emotional costs (Hampshire et al., 2017). It is against this backdrop that this paper seeks to present evidence relevant to the possibility of integrating 'informal' mhealth into the formal health system of Ghana in order to achieve universal health coverage in the country.

Methods

This paper draws on data collected in Ghana as part of the IMAGINE project (Informal mhealth in Africa: Grassroots Innovations & Networks): a broader multi-country collaborative research project covering Ghana, Ethiopia and Malawi. The study used a sequential mixed-methods approach. In Ghana, this comprised: (i) a literature and policy review related to mhealth initiatives; (ii) an initial set of nine focus group discussions (FGDs) with CHNs across three Regions: Central, Brong-Ahafo and Northern (pre-2018 classifications) and key informant interviews with stakeholders; (iii) a comprehensive quantitative survey of 598 CHNs across the three Regions; and (iv) a further round of qualitative fieldwork with CHNs, patients/clients, and national level stakeholders to help interpret the survey findings. This paper draws largely on the qualitative work among CHNs and literature review, contextualised within the headline survey results, to produce an in-depth account of the participants' motivations, experiences and wider reflections on using personal mobile phones, and how such informal mhealth could be integrated into the healthcare delivery system in the country. Further methodological details are given below.

In the first phase, we conducted a review of the existing literature (both peer-reviewed and grey literature) and policy initiatives. This type of review has been characterised by Khangura et al. (2012 cited in Tricco et al., 2015, p. 2) as 'a type of knowledge synthesis in which components of the systematic review process are simplified or omitted to produce information in a short period of time'. It is used to obtain a relatively quick but rigorous synthesis of evidence within a specific field of inquiry (Khangura et al., 2012; Tricco et al., 2015). Using Google Scholar, Google and other search engines, we searched for and reviewed relevant published literature and available grey literature on mhealth initiatives in Ghana, in order to ascertain the current state of mhealth implementation in the country, and to collate relevant policies and guidelines. The review helped inform design of research instruments for the empirical data collection that followed.

During the second phase, nine FGDs were organised across three regions (Central, Brong-Ahafo, and Northern Regions), spanning Ghana's three ecological zones (savanna, forest and coastal). Three FGDs were conducted per Region (one urban setting, one peri-urban and one rural, reflecting potentially different kinds of experiences). Each FGD comprised 6–10 CHNs who were purposively selected (depending on their availability) to reflect their years of experience and length of stay in the selected health facility. Though the FGDs comprised both males and females, most of the participants were females because community health nursing is a female-dominated activity in Ghana (Owusu et al, forthcoming). The FGDs were conducted in designated areas (mostly within the health facility) suggested by the respondents, and were moderated and recorded by trained research assistants. All the discussions were held in the English Language because all the selected CHNs could speak English. We also conducted five interviews with key national stakeholders to elicit their perspectives and experiences regarding community healthcare delivery and mobile health. These stakeholders represented the following organisations: Christian Health Association of Ghana (CHAG); National Youth Employment Agency (NYEA); The Ghana Health Service (GHS), Millennium Promise (implementers of the One Million CHWs Project) and the Community Health Nurses Association of Ghana. These interviews were conducted by trained research assistants in the offices or designated areas and time suggested by the respondents. With informed consent from all participants (through signed informed consent forms), interviews and FGDs were tape-recorded. To ensure validity and reliability of responses, interviewers repeated the responses for the interviewees to confirm or modify. This ensured that the responses were accurately captured and represented by the interviewers or the recorders. The data from the audio-recorded files for both the interviews and the FGDs were transcribed and analysed manually, by developing a template that captured all the emerging themes from the study, such as mobile phone ownership and use, benefits and challenges of informal mhealth. This approach enabled us to compare responses in order to identify similarities and differences and to provide rigorous qualitative insights into the use of

personal mobile phones for healthcare delivery and how it could be integrated into the country's health system.

In the third phase, the analysis of the FDG data informed the design of a questionnaire administered to 598 CHNs, who were randomly selected across fifteen districts in the three study regions. Finally, we conducted a further round of interviews with CHNs (N=18) and 18 FGDs with patients/clients, to help contextualise the survey findings and probe further on the potential and opportunities for promoting and improving the practice of 'informal mhealth'. As noted above, this paper draws mainly on the qualitative data and the literature review, contextualised within the key survey findings. See Hampshire et al (forthcoming), Abane et al. (forthcoming) and Owusu et al. (forthcoming) for a more comprehensive analysis of the survey data.

The study adhered to all ethical considerations in conducting social science research. Ethical approval for the study was given by the Ethical Review Committee of the Ghana Health Service, Ghana, and the Ethical Review Board of Durham University, UK.

Results

Selected 'formal' mhealth initiatives in Ghana

As noted earlier, the experience of 'formal' mhealth in Ghana has been similar to many other countries, where time-limited, small-scale pilot projects prevail. In this section, we present a review of selected initiatives implemented in the country, based on their relevance to our study, along with reflections from key informants whose organisations have direct experience of designing and implementing mhealth.

The review identified the MOTECH programme (Mobile Technology for Community Health) as among the high-profile mhealth initiatives in Ghana. MOTECH was a collaboration between Grameen Foundation, the Ghana Health Service and the Mailman School of Public Health (Columbia University), with financial support from the Bill & Melinda Gates Foundation (BMGF). The MOTECH platform was launched in July 2010 in the Kassena-Nankana West (KNW) District in the Upper East Region, and was later implemented in the Awutu Senya District in the Central Region in 2011. With additional funding from USAID and BMGF in 2012, MOTECH was replicated in three additional Districts: Gomoa West in Central region, Dangme East in Greater Accra region, South Tongu in the Volta region (LeFevre et al., 2017). The aim of the intervention was to improve uptake and quality of care of maternal, newborn and child health services (MNCH) through the use of low-cost mobile phone technology to capture, transmit and process health service data collected by CHNs (Grameen Foundation, 2011). The project had ambitious goals for scaling up not just nationwide in Ghana, but also becoming 'a showcase for replications throughout Africa and the world' (Grameen Foundation, 2012, p. 2). While some successes were chalked (including increased antenatal visits, and improved reporting system), the evaluation report revealed that financial and other related challenges had prohibited scale up and sustainability of the intervention beyond the lifetime of the project.

Subsequent to MOTECH, Grameen Foundation also piloted the 'CHN-on-the-Go' app and MobiHealth Volunteers App in 2014–2015, in collaboration with Concern Worldwide, John Snow International and the Ghana Health Service. The CHN-on-the-Go uses point-of-care mobile technology to assist CHNs in remote areas to improve quality of diagnosis and care; facilitate professional development and provide up-to-date medical reference and training guides (grameenfoundation.org). The MobiHealth Volunteers App also allowed community volunteers to send medical alerts to a CHN for prompt response and service delivery. These interventions were also short-lived and were not scaled up beyond the pilot districts (grameenfoundation.org).

Another mhealth relatively high-profile intervention was the Ghana Telemedicine Project, which utilised ICT to improve the delivery of primary health services by strengthening human resources (Ekanoye et al., 2017). The project was initiated in the Amansie West District of the Ashanti region

by the Novartis Foundation for Sustainable Development (NFSD), in collaboration with several agencies including the Ministry of Health in Ghana, the Ghana Medical Association and the Millennium Villages Project (MVP). The project employed ‘teleconsultation’ (consultations via mobile phones) ‘to reduce transportation time and costs for patients and their families, to increase medical knowledge and safety in primary healthcare facilities, and to strengthen local capacities in e-health’ (Novartis Foundation for Sustainable Development, *n.d.*, pp. 2–3). The project covered 21 communities and seven health facilities, establishing a teleconsultation centre at the District Hospital in Agroyesum and providing mobile phones and a 24-hour emergency toll-free number (Ekanoye et al., 2017; Opoku et al., 2015). The strategy was to directly connect CHNs with physicians at the District Hospital through structured consultations and established protocols (Novartis Foundation for Sustainable Development, *n.d.* Opoku et al., 2015). Although the pilot received some positive feedback from health-workers and reportedly reduced patient travel and referrals, it also faced significant technical and administrative challenges such as ‘phone service delays, stressful workloads on the telecommunication staff, and inadequate information received from phone calls’ (Ekanoye et al., 2017, p. 386), and never achieved the ambition of national scale-up.

In addition, interviews with some of the stakeholders confirmed some of the challenges reported in project documentation. The following excerpts from an interview with an official from CHAG (Christian Health Association of Ghana), which had piloted two mhealth programmes, highlight some of the challenges in sustaining programmes even when positive results have been achieved at a small scale:

Between 2015 and 2016, CHAG implemented the MDG Accelerated Framework (MAF) with funds from the European Union and DANIDA (Danish International Development Agency) through the Ministry of Health of Ghana. We created a WhatsApp group platform for hospitals, consisting of five members each from a hospital including a Doctor, an Emergency Nurse, a Hospital Administrator, a Public Health Nurse and a Midwife. The members on the platform were able to put medical cases on the platform for group access and support. Referred cases were also put on the platform to facilitate advance preparation. The members were also meeting every 100 days to review their activities, share success stories and failures, and discuss maternal and child mortality reduction strategies because our target was to achieve zero rate of maternal and child death. At the end of the implementation period, we were able to reduce maternal and child health-related cases by 24.8%. The platform is still existing but we are no longer able to organise the face-to-face meetings due to funding challenges.

Within the public sector, an interview with an official of the Ghana Health Service (GHS) revealed more pressing challenges in community healthcare that are prioritised over comprehensive mhealth delivery:

I am not sure the MOH or GHS will be rolling out a full mhealth package for CHNs in Ghana. There are about fifteen (15) basic checklists to qualify as a CHPS compound in Ghana. Currently, there are a number of compounds that do not even meet these criteria. The basic logistics (motorbikes, etc.) needed to enable them perform are not available. The nurses have to use their own money to buy some of these logistics (such as fuel) to support healthcare delivery in Ghana. There are now a number of trained and qualified CHNs who have not even been posted to the communities although their services are needed badly. So, I don’t see government bypassing these to roll out mhealth. [GHS official]

Ownership and use of mobile phones by the CHNs

The basic requirement for mhealth is, of course, phone ownership (or access). The survey results in Ghana demonstrate that, while only about 16% of CHNs surveyed had access to a functional *official* mobile phone for work-related purposes, almost all (99%) had a personal mobile phone, with most of these personal phones being internet-based (91.7%). The overwhelming majority (97.6%) of CHNs reported using their personal phone for healthcare delivery, and on a regular basis (90.5%): Table 1.

Table 1. Access and use of mobile phones.

Access and use of mobile phones	N=598
Access to official mobile phones	
Mobile phone or tablet in working order	15.9
Mobile phone or tablet not in working order	2.0
Previous mobile phone or tablet	0.8
No mobile phone or tablet	81.3
Ownership of personal mobile phones	
Personal mobile phone in working order	99.0
Personal mobile phone not in working order	0.7
Previous mobile phone	0.1
Never owned a personal mobile phone	0.1
Ownership of personal internet-enabled mobile phone	
Yes	91.7
No	8.3
Use of personal mobile phones for work-related purposes	
Yes	97.6
No	2.4
Frequency of use of personal mobile phones for work	
	Cumulative Frequency
Every day/most days	90.5
At least once a week	99.2
At least once a month	99.9
None/Never	0.1

Source: Survey data (2019).

Opportunities for ‘informal’ mhealth among CHNs in Ghana

In-depth interviews and FDGs with CHNs enabled us to understand, in more detail, exactly *how* CHNs were using personal mobile phones in their work, and with what (perceived) impacts. The following excerpts illustrate the diversity of uses to which CHNs are putting their phones in order to help with their work, including: getting an advice from a superior during an emergency, sending reports, reminding clients on due dates for reviews, making advance arrangements for community outreach services, and facilitating advance preparation for referral cases (these corroborate the findings of our earlier, smaller-scale study: Hampshire et al., 2017).

Somewhere in 2012 when I had just been posted to my compound, I had a poisoning case. It was a serious one and we wanted to refer the client, but we didn’t have any means of transport. So, I had to call a doctor [the then District Director of Health Services] who gave me the guidelines as to what to do, and by God’s grace, I followed it and it worked perfectly for me. And since then, that is how I have been treating similar cases. [Rural FGD Participant, Central region]

Just recently we went for a training on a new vaccine. In fact, I couldn’t get clearly what the whole thing was about, and for that matter, I was missing the treatment of some cases. So, I had to call the Disease Control Officer in the district for clarification, which he did. So, had it not been the phone, I wouldn’t have been able to deliver my services very well [Urban FGD Participant, Northern region].

We take the contact for our family planning (FP) clients so that we could contact them any time they are due for any procedure. We have to do that because some of the clients even forget their scheduled dates for procedures, and they eventually get pregnant. So, in order to prevent these, we have been calling them [Rural FGD Participant, Brong Ahafo region].

We have an informal [WhatsApp] platform called ‘The Labour Room’. This platform has been very helpful because anytime you are referring a pregnant woman to a different facility, you only post the details of the client on the platform for the receiving facility to prepare and wait for that person. So, you don’t have to go with any letter or something like that. We have both regional and district ‘Labour Rooms’ [Rural FGD Participant, Northern region].

These uses of informal mhealth were also recognised by health administrators and regulators. For example, the CHAG official noted the potential of informal mhealth in improving healthcare delivery:

Health workers cannot be everywhere in the country, so mobile phones can be used to enhance health service delivery and data collection from health facilities. Analysis of data from some health facilities is sometimes a challenge or becomes a problem, so mobile phones could be used to facilitate our health data collection process. Through the use of mobile phones [both formal and informal], clients can make appointments and access health information. I believe all these will facilitate our quest for universal health coverage. Indeed, the limited number of health staff makes the use of mobile phones to support healthcare delivery very imperative. [CHAG official]

Similarly, an official of the Ghana Health Service (GHS) recognised the value of mobile phones for reporting information to the district offices, thereby reducing the amount of time and resources spent on health administration:

The Ghana Health Service has a reporting system called District Health Information Management System (DHIMS); so I think that if the reporting forms are standardised and programmed, the CHNs could use their personal mobile phones to capture and send the information to the relevant authorities. This could reduce the amount of time spent on health administration. [GHS official]

Challenges of 'informal' mhealth in Ghana

While they were generally positive about the benefits of using personal mobile phones in their work, CHNs and policy makers also drew attention to some potentially serious challenges: financial, practical, emotional and moral. These should be understood in the context of the particular nature of their work, the geographical scope of their activities, and the fact that CHNs are among the least paid in the health system in Ghana (Hampshire et al., 2017).

As the following quotes revealed, one set of challenges related to practical and financial aspects of phone use and maintenance, including the cost of airtime and data, as well as irregular supply of electricity, and drain on battery life (especially in rural areas where access to electricity is poor):

Yes, there are some challenges. ... using your own credit for all of these activities is sometimes draining on your income. And again, you will also have to send pictures and information ... which requires [internet] data. So, it's a challenge for all of us since we don't get refund for the airtime and the data that we use during work activities. [IDI, official of CHNs Association of Ghana]

Sometimes I am supposed to use 10 Ghana Cedis of credit in a month but because I am using much credit for work, I may use 20 or 30 Ghana Cedis and this increases the cost [Urban FGD Participant, Brong Ahafo region]

The numerous calls also become a drain on battery power of our phones. So, you will realise that in most cases our phones will be going off, and that too becomes a disadvantage to our work. This is because, when the phone goes off, you are unable to deliver quality service [Peri-urban FGD Participant, Brong Ahafo region].

Another major challenge to CHNs' wellbeing is the after-hours calls, especially at night. Some nurses reported regularly disrupted sleep or domestic quarrels due to phone calls at night:

It's sometimes helpful and bad at the same time. After using your phone to call a client, they tend to call sometimes in the middle of the night when you are sleeping. Sometimes, after listening to the client, you realise that whatever he/she wanted to say could have waited till the next morning [Urban FGD Participant, Northern region].

My husband told me one morning that a man, who was my client, called my phone around 10pm while I was asleep. In fact, we had to quarrel a bit about that [Peri-urban FGD Participant, Northern region].

In addition to the social, emotional and economic burdens on CHNs, using personal phones also presents challenges of confidentiality and privacy as nurses may keep confidential health

information of patients/clients on their phones. This is particularly critical as it has been established that phones are often ‘shared’ with family members and friends (LeFevre et al., 2017).

There is no confidentiality and privacy on your phone because ... there is some information you may not need but you are forced to leave on your phone for future reference. ... Example is a report or a document [Urban FGD Participant, Brong Ahafo region].

Finally, health-workers’ use of personal mobile phones for work raises issues of ‘trust’ and a separation between work and non-work calls, especially during working hours, as this GHS official noted.

I am sometimes pessimistic with the use of personal mobile phones by health workers. They will tell you that they are using them for healthcare delivery support but in actual fact, some of them use it for private activities at the expense of professional service delivery. I have personally observed this and it’s a worry. One day, I went to a health facility as a ghost patient. I observed that some of the nurses at the facility were just using their mobile phones while patients were being neglected. There was, however, one nurse who was very professional and attended to the patients. I gave her a reward of 20.00 Ghana Cedis, and I nearly reprimanded the culprits. This happened two years ago. [GHS official]

However, as the CHAG interviewee explained, sometimes this might be more to do with patients’ perceptions than a reality:

... , there is a challenge of ethical dilemma, where midwives will be using their phones to find solutions for clients, but clients may see this as being neglected. [CHAG official]

Strategies to integrate informal mhealth in the health system of Ghana

As has been revealed, ‘informal mhealth’ presents both opportunities and challenges for achieving universal health coverage. Government agencies, health administrators and regulators should , therefore, devise realistic strategies that will maximise the benefits while minimising the challenges. In this regard, we present some strategies as proposed by the respondents of our study. Since almost all the CHNs already have mobile phones, mostly internet-based, some of them proposed that, in order to motivate them to use their phones for work related activities, the Ghana Health Service or non-governmental organisation (NGOs) should support them with airtime and/or data:

Maybe 100 Ghana Cedis per month will be ok; 50 Ghana Cedis for voice call and 50 Ghana Cedis for [internet] bundle for us to go to google to search for some information. [Urban FGD Participant, Brong Ahafo region]

Oh, as for the credit when we get it, it will really help but 20 Ghana Cedis per month won’t be enough because ... calling other networks is expensive and your credit moves very fast. So maybe about 50 or 40 Ghana Cedis per month wouldn’t be bad and it can be through our account or mobile money (Rural FGD Participant, Brong Ahafo region).

It [credit] should be on weekly basis. Every week we send a report to the District Health Directorate, so when we send it and use 10 Ghana Cedis for bundle and 10 Ghana Cedis for call, I think that one will be ok [Rural FGD Participant, Central region].

In an interview with some national stakeholders, they agree that some support should be provided for health-workers to reduce the burden associated with personal phone expenditure for work-related activities. However, a concern was raised about equity and ensuring that subsidised airtime/data are used for work-related, rather than, personal activities:

Providing credit for the nurses will be a good idea but how do we regulate abuses, such as using the credit for personal gains instead of work-related issues? [CHAG official]

We can encourage CHWs to use their mobile phones to support healthcare but I think the challenge we will face is the provision of call credits [NYEA official].

While these are genuine concerns, monitoring the use of phone credit for work-related activities may not be feasible or indeed necessary. We already know that CHNs spend their own money

for work-related phone use; according to the survey, over two-third reported spending more than 5 Ghana Cedis per week on average (see Table 2). The key issue is surely to recognise this through some form of compensation rather than to try to monitor use of work-related and personal credit.

Discussion

Our study is one of the most comprehensive studies to investigate the use of ‘informal’ mhealth to improve healthcare delivery in Ghana. In this regard, our review of some selected mhealth initiatives reveals that, like other developing countries, Ghana, through some NGOs, has implemented a number of formal mhealth initiatives, with notable successes and challenges for scalability and sustainability. However, we observed that formal mhealth remains characterised by Huang et al.’s (2017, p. 2) concept of ‘Pilotitis’ or what Whyte et al. (2013) referred to as ‘projectified landscapes of care’; that is, successfully delivering narrowly defined initiatives to small populations but never scaling up. The negative effects of ‘projectification’ or ‘pilotitis’ are enormous. For example, when projects phase out, it is often wrongly assumed that governments will take over and build on the successes (Park, 2014), when in fact, poorly-resourced Ministries of Health can instead become passive recipients of interventions whose successes cannot effectively be scaled up. Park (2014) also calls attention to infrastructural challenges of ‘projectification’, whereby ownership and responsibility for maintenance becomes problematic. Without a clear national roadmap, and sufficient resources in place, it is perhaps unrealistic to expect donor-supported, time-limited initiatives to be sustained when external funding ceases, let alone be scaled up.

Meanwhile, most of the stakeholders we interviewed reiterated the immense potential of mhealth in bridging the healthcare in Ghana. However, funding and operational challenges prevented the scaling up of the interventions. In addition, some officials are of the view that there are currently more pressing healthcare challenges facing the national healthcare system, such as basic logistics and fuel for monitoring, than implementing a nationwide mhealth programme. Although the focus on ensuring that basic logistics for the work of CHNs is completely understandable, it must be noted that some of the logistical challenges could potentially be ameliorated through the use of mhealth (formal and/or informal), especially as our study has revealed that almost all the selected CHNs are already using their own mobile phones to deliver healthcare. Examples include getting advice from a superior during an emergency, sending reports, reminding clients on scheduled dates for reviews, making advance arrangements for community outreach services, and facilitating advance preparation for referral cases. As Mahmud et al. (2010) noted, mhealth can significantly reduce face-to-face contact time and health-workers’ fuel costs, while Odendaal and Lewin (2014) indicated that mhealth can improve efficiency through reducing unnecessary travel. More specifically, a study in Ghana by Andreatta and her colleagues concluded that ‘Cell phones provide a direct and individualized medium for integrating social groups and sustaining networks. Their wide use could be practical for developing M-health networks, especially during emergency

Table 2. Expenditure and time spent on phone for work-related activities.

Amount per week	Frequency	Percent
Less than 5 GHS	193	32.3
GHS 5–10	346	58.0
More than GHS 10	58	9.7
Total	597	100.0
Minutes per day	Frequency	Percent
Less than 30	204	34.2
30–60	191	32.0
More than 60	202	33.8
Total	597	100.0

N/B: At the time of data collection, USD 1.00=GHS 5.00.
Source: Survey data (2019).

situations, because they enable quick and direct access to others, regardless of physical location.' (Andreatta et al., 2010, p. 149). In a similar study, Laar et al. (2019, p. 6) found that mhealth initiatives in Ghana *reduce distance and cost of accessing and utilizing healthcare services*. This may significantly improve access to and utilisation of healthcare services, particularly in resource-limited settings. These initiatives may contribute to the achievement of the principles of universal health coverage, because they help in providing healthcare to a set of population that may otherwise be left behind.

More importantly, these reported uses of 'informal mhealth' tend to mirror the 'formal' mhealth interventions implemented in Africa and other parts of the world (Blaschke et al., 2009; Ekanoye et al., 2017; Labrique et al., 2013; LeFevre et al., 2017; Lin et al., 2012; Mahmud et al., 2010; Odendaal & Lewin, 2014; Zurovac et al., 2011; Zurovac et al., 2012), and presents a potentially cost-effective means to support healthcare delivery in Ghana. This is particularly important because a study by Peprah et al. (2020; 2019) found high willingness of the health professionals to adopt mhealth initiatives in Ghana. Thus, when properly implemented and regulated, 'informal' mhealth will contribute to the achievement of universal health coverage by bridging the healthcare gap between the rich and the poor as well as between rural and urban areas (Laar et al., 2019), thereby fulfilling the important catch phrase of 'leave no one behind'.

However, our study revealed some technical challenges that may hinder the realisation of full benefits of the informal mhealth initiatives. Interestingly, these challenges have also been observed by other studies that investigated the adoption of mhealth in other parts of the continent or elsewhere. These include poor telecommunication network coverage (Hampshire et al., 2017; Laar et al., 2019; LeFevre et al., 2017; Peprah et al., 2020;) and poor access to electricity to charge phones (Hampshire et al., 2017; Huang et al., 2017; Laar et al., 2019). Therefore, governments and private sector should combine effort to address these challenges in order to take advantage of the substantial opportunities offered by mhealth in achieving universal health coverage.

In addition to the technical challenges indicated above, one other challenge with the use of personal mobile phone was the issue of trust relating to whether CHNs were using their phones for work or for private business during official working hours. Of course, such challenges may arise with any equipment used at the workplace, but the blurring of work/non-work boundaries is perhaps particularly tricky and difficult to monitor with personal mobile phones. For example, it might be difficult to monitor and ascertain whether CHNs are interacting on social media for their private activities/benefits or they are seeking information to support healthcare delivery; in many cases, it may be both at the same time.

Therefore, in order to integrate informal mhealth into the healthcare system of Ghana, our study points to the provision of phone credits to CHNs as suggested by most of our respondents. We are of the view that providing a phone credit allowance would be substantially cheaper than the standard mhealth package of providing mobile phones, as was recognised in a Grameen Foundation evaluation report of the MOTECH initiative. At its launch, MOTECH provided more than 40 nurses with Nokia 1680 phones at a cost of about \$40 per phone, in addition to the cost of airtime and data for reporting (Grameen Foundation, 2011). When the project was evaluated, it was concluded that *'using nurses' own phones would eliminate the upfront cost of hardware provision thus making the project more accessible to and sustainable for government agencies in resource-limited settings'* (Grameen Foundation, 2011, p. 16).

Another issue with the provision of mobile phones to CHNs (rather than supporting costs of personal phone use) relates to policies on usage and risks of theft/loss. Evidence suggests that punitive policies to regulate phone use may be counter-productive as nurses may not use it at all (Grameen Foundation, 2011); a view confirmed by the CHAG official:

The problem with institutional mobile phones is ownership and care.... If you over-regulate the facility phones in terms of usage, people may not use it at all. So, while it is worth considering, it should be done with caution. [CHAG official]

Instead, a comprehensive policy or training for CHNs on the use of personal phones could be more effective, as a GHS official suggested: ‘*What I will recommend is a training for CHNs on responsible use of mobile phones at workplaces*’. In summary, provision of airtime and data to support CHNs’ use of personal phones in their work could be a more sustainable and cost-effective strategy than rolling out yet another high-cost ‘formal’ mhealth programme.

Conclusions

In conclusion, the potential for mhealth to help achieve Universal Health Coverage, especially in LMICs, remains substantial, but that potential has not yet been realised at a large scale. So far, there has been no nation-wide deployment of mhealth interventions, and most interventions to date have stalled at the pilot stage.

By contrast, our research has demonstrated that community health nurses (CHNs) in Ghana, through self-motivation and commitment, are already using their personal mobile phones in innovative ways to facilitate healthcare delivery (‘informal’ mhealth), and that they are doing this on a large scale. However, while these efforts have the potential to contribute to the achievement of Universal Health Coverage, they are putting enormous economic, social and emotional burden on the CHNs who are generally among the least-paid health workers in the country.

There is thus a strong argument for the Ministry of Health and the Ghana Health Service to seriously explore potential strategies for integrating ‘informal’ mhealth into formal healthcare delivery. To achieve this, without CHNs being required to bear a disproportionate burden, serious consideration needs to be given to the idea of supporting CHNs with airtime and data. Even having a dedicated line of their pay cheque indicating a small communication allowance might go a long way to motivate the nurses to continue using their own mobile phones while remaining committed to duty.

To help offset the costs of this, the Government of Ghana could liaise with telecommunication companies to support this initiative as a corporate social responsibility. Similarly, development partners and NGOs could also be brought on board with what could be a much more sustainable and affordable way of achieving some of the benefits of mhealth at a national scale.

In summary, ‘informal mhealth’ may well be key to bridging healthcare gap in resource-poor areas but, to capitalise on these, governments must recognise and support the efforts of health-workers, especially those working at community level on relatively low salaries. To ensure that personal mobile phones are used ethically and professionally by health-workers to help support effective and sustainable healthcare delivery, we recommend that the GHS, through national stakeholder consultations, should develop a comprehensive policy on incentives and the use of mobile phones at the workplace. Although this study was conducted among CHNs, the policy recommendations may be relevant to the use of informal mhealth by other categories of health workers in the country.

Ethical approval

Ethical approval for this project was given by the Ghana Health Service Ethical Review Committee and Durham University Ethical Review Board, UK.

Acknowledgements

We are grateful to the UK Medical Research Council for funding this project. We would like to thank Jane Araba Amponsah, Kwamena Dickson, Joycelyn Affum, and Isaac Ofori of the University of Cape Coast, for research assistance. We are also grateful to all participants who took time off their busy schedules to share their views and experiences with us.

Disclosure statement

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

Funding

This research project was funded by the UK Medical Research Council (grant number MR/R003963/1), the Economic and Social Research Council (ESRC), the Wellcome Trust, and the UK Foreign, Commonwealth & Development Office (formerly Department for International Development), under the Health Systems Research Initiative (HSRI).

ORCID

Simon Mariwah  <http://orcid.org/0000-0003-0803-9746>

Adetayo Kasim  <http://orcid.org/0000-0002-0411-3059>

Elsbeth Robson  <http://orcid.org/0000-0003-3513-460X>

References

- Agarwal, S., Perry, H. B., Long, L.-A., & Labrique, A. B. (2015). Evidence on feasibility and effective use of mHealth strategies by frontline health workers in developing countries: Systematic review. *Tropical Medicine and International Health*, 20(8), 1003–1014. <https://doi.org/10.1111/tmi.12525>
- Andreatta, P., Debpuur, D., Danquah, A., & Perosky, J. (2010). Using cell phones to collect postpartum hemorrhage outcome data in rural Ghana. *International Journal of Gynecology and Obstetrics*, 113(2), 148–151. <https://doi.org/10.1016/j.ijgo.2010.11.020>
- Blaschke, S., Bokenkamp, K., Cosmaciuc, R., Denby, M., Hailu, B., & Short, R. (2009). *Using mobile phones to improve child nutrition surveillance in Malawi*. Mobile Development Solutions; UNICEF Malawi and UNICEF Innovations.
- Bogan, M., van Esch, J., Mhila, G., DeRenzi, B., Mushi, C., Wakabi, T., Lesh, N., & Mitchell, M. (2009). *Improving standards of care with mobile applications in Tanzania*. A paper presented at the W3C Workshop on the Role of Mobile Technologies in Fostering Social and Economic Development in Africa. April 1, 2009 Maputo, Mozambique.
- de Tolly, K., & Alexander, H. (2009, March 1). Soul Beat Africa-HIV/AIDS. Innovative use of cellphone technology for HIV/AIDS behaviour change communications: 3 pilot projects. <http://www.comminit.com/?q=hiv-aids-africa/node/308917>.
- Ekanoye, F., Olokunde, T., Ayeni, F., Mende, C. M., Nina, V., & Mbarika, V. (2017). Telemedicine Diffusion in a developing country: A case of Ghana. *Science Journal of Public Health*, 5(5), 383–387. <https://doi.org/10.11648/j.sjph.20170505.14> doi:10.11648/j.sjph.20170505.14
- Grameen Foundation. (2011). *Mobile technology for community health in Ghana: what it is and what Grameen Foundation has learned so far*. Second edition: March 2011.
- Grameen Foundation. (2012). *Mobile technology for community health in Ghana: what it is and what Grameen Foundation has learned so far*. Second edition: September 2012.
- Hampshire, K., Porter, G., Mariwah, S., Robson, E., Munthali, A., Owusu, S. A., Abane, A., & Milner, J. (2017). Who bears the cost of ‘informal mhealth’? Health-workers’ mobile phone practices and associated political-moral economies of care in Ghana and Malawi. *Health Policy and Planning*, 32(1), 34–42. <https://doi.org/10.1093/heapol/czw095>
- Hampshire, K., Porter, G., Owusu, S. A., Mariwah, S., Abane, A., Robson, E., Munthali, A., DeLannoy, A., Bango, A., Gunguluza, N., & Milner, J. (2015). Informal m-health: How are young people using mobile phones to bridge healthcare gaps in Sub-Saharan Africa? *Social Science & Medicine*, 142, 90–99. <https://doi.org/10.1016/j.socscimed.2015.07.033>
- Hartzler, A., & Wetter, T. (2014). *Engaging Patients through Mobile Phones: Demonstrator Services, Success Factors, and Future Opportunities in Low and Middle-income Countries*. IMIA Yearbook of Medical Informatics 2014.
- Huang, F., Blaschke, S., & Lucas, H. (2017). Beyond pilotitis: Taking digital health interventions to the national level in China and Uganda. *Globalization and Health*, 13(1), 49. <https://doi.org/10.1186/s12992-017-0275-z>
- International Telecommunication Union (ITU). (2019). *Global mobile cellular subscription 2000-2018*.
- Khangura, S., Konnyu, K., Cushman, R., Grimshaw, J., & Moher, D. (2012). Evidence summaries: The evolution of a rapid review approach. *Systematic Review*, 1(1), 10. <https://doi.org/10.1186/2046-4053-1-10> doi:10.1186/2046-4053-1-10
- Laar, A. S., Bekyieriya, E., Isang, S., & Baguune, B. (2019). Assessment of mobile health technology for maternal and child health services in rural Upper West region of Ghana. *Public Health*, 168, 1–8. <https://doi.org/10.1016/j.puhe.2018.11.014>
- Labrique, A. B., Vasudevan, L., Kochi, E., Fabricant, R., & Mehl, G. (2013). Mhealth innovations as health system strengthening tools: 12 common applications and a visual framework. *Global Health: Science and Practice*, 1(2), 160–171. <https://doi.org/10.9745/GHSP-D-13-00031>
- LeFevre, A. E., Mohan, D., Hutchful, D., Jennings, L., Mehl, G., Labrique, A., Romano, K., & Moorthy, A. (2017). *Mobile technology for community health in Ghana: What happens when technical functionality threatens*

- the effectiveness of digital health programs? *BMC Medical Informatics and Decision Making*, 17(1), 27. <https://doi.org/10.1186/s12911-017-0421-9>
- Lin, H., Chen, W., Luo, L., Congdon, N., Zhang, X., Zhong, X., Liu, Z., Chen, W., Wu, C., Zheng, D., Deng, D., Ye, S., Lin, Z., Zou, X. & Liu, Y. (2012). Effectiveness of a short message reminder in increasing compliance with pediatric cataract treatment: A randomized trial. *Ophthalmology*, 119(12), 2463–2470. <https://doi.org/10.1016/j.ophtha.2012.06.046>
- Mahmud, N., Rodriguez, J., & Nesbit, J. (2010). A text message-based intervention to bridge the healthcare communication gap in the rural developing world. *Technology & Health Care*, 18(2), 137–144. <https://doi.org/10.3233/THC-2010-0576>
- Michael, P. N. (2009). The case for mHealth in developing countries. *Innovations: Technology, Governance, Globalization*, 4(1), 103. <https://doi.org/10.1162/itgg.2009.4.1.103> doi:10.1162/itgg.2009.4.1.103
- Mehl, G., & Labrique, A. (2014). Prioritizing integrated mHealth strategies for universal health coverage. *Science*, 345(6202), 1284–1287. <https://doi.org/10.1126/science.1258926>
- Mehl, G. L., Tamrat, T., Bhardwaj, S., Blaschke, S., & Labrique, A. (2018). Digital health vision: Could MomConnect provide a pragmatic starting point for achieving universal health coverage in South Africa and elsewhere? *BMJ Global Health*, 3, e000626. <https://doi.org/10.1136/bmjgh-2017-000626>
- Mitchell, M., Hedt-Gauthier, B. L., Msellemu, D., Nkaka, M., & Lesh, N. (2013). Using electronic technology to improve clinical care—results from a before-after cluster trial to evaluate assessment and classification of sick children according to integrated management of childhood Illness (IMCI) protocol in Tanzania. *BMC Medical Informatics Decision Making*, 13(1), 1–8. <https://doi.org/10.1186/1472-6947-13-95>
- MoH. (2014). *Government of Ghana: National community health Worker (CHW) programme*. Ministry of Health.
- MoH. (2016). *Community-Based health Planning and services (CHPS) policy*. Ministry of Health.
- National Communications Authority. (2016). *Quarterly statistical bulletin on communications in Ghana* (Vol. 1, issue 2). National Communications Authority.
- Novartis Foundation for Sustainable Development. (n.d.). *Telemedicine Project in Ghana*. Accessed on 18/5/2019 from www.novartisfoundation.org.
- Odendaal, W. A., & Lewin, S. (2014). The provision of TB and HIV/AIDS treatment support by lay health workers in South Africa: A time-and-motion study. *Human Resources for Health*, 12(1), 18. <https://doi.org/10.1186/1478-4491-12-18>
- Opoku, D., Scott, P., & Quentin, W. (2015). Healthcare professionals' perceptions of the benefits and challenges of a teleconsultation Service in the Amansie-West District of Ghana. *Telemedicine and e-Health*, 21(9), 748–755. <https://doi.org/10.1089/tmj.2014.0210>
- Owusu, S. A. (2017). *Child caregiving practices in the Kumasi Metropolis, Ghana* (Doctoral dissertation). University of Cape Coast. <https://ir.ucc.edu.gh/jspui/bitstream/123456789/3671/1/OWUSU%202017.pdf>
- Owusu, S. A., & Amoako-Sakyi, R. O. (2011). Mobility and economic constraints as key barriers to children's health-seeking in Ghana. *Society, Biology and Human Affairs*, 76(1), 91–105.
- Park, S.-J. (2014). *Staging global public health: Workshops, technologies of participation, and the authorization of knowledge in antiretroviral therapy in Uganda*. Working Papers Series NR. 6.
- Peprah, P., Abalo, E. M., Agyemang-Duah, W., Budu, H. I., Appiah-Brempong, E., Morgan, A. K., & Gyimah, A. A. (2020). Lessening barriers to healthcare in rural Ghana: Providers and users' perspectives on the role of mHealth technology. A qualitative exploration. *BMC Medical Informatics and Decision Making*, 20(27), 1–12. <https://doi.org/10.1186/s12911-020-1040-4>
- Peprah, P., Budu, H. I., Agyemang-Duah, W., Abalo, E. M., & Gyimah, A. A. (2019). Why does inaccessibility widely exist in healthcare in Ghana? Understanding the reasons from past to present. *Journal of Public Health*, 28(1), 1–10. <https://doi.org/10.1007/s10389-019-01019-x>
- Tricco, A. C., Antony, J., Zarin, W., Striffler, L., Ghassemi, M., Ivory, J., Perrier, L., Hutton, B., Moher, D., & Straus, S. E. (2015). A scoping review of rapid review methods. *BMC Medicine*, 13(224), 1–15. <https://doi.org/10.1186/s12916-015-0465-6>
- United Nations. (2015). *UN Sustainable Development Goals*. Retrieved March 15, 2018, from <https://www.un.org/sustainabledevelopment/health/>.
- Whyte, S. R., Whyte, M. A., Meinert, L., & Twebaze, J. (2013). Therapeutic Clientship: Belonging in Uganda's Mosaic of AIDS projects. In J. Biehl & A. Petryna (Eds.), *When people Come first: Anthropology and social Innovation in Global health* (pp. 140–165). Duke University Press.
- World Health Organization. (2011). *mHealth New horizons for health through mobile technologies*. Global Observatory for eHealth series – Volume 3 2011. Retrieved June 1, 2014, from http://www.who.int/goe/publications/goe_mhealth_web.pdf.
- Zurovac, D., Larson, B. A., Sudoi, R. K., & Snow, R. W. (2012). Costs and cost-effectiveness of a mobile phone text-message reminder programmes to improve health workers' adherence to malaria guidelines in Kenya. *PLoS One*, 7(12), e52045. <https://doi.org/10.1371/journal.pone.0052045>
- Zurovac, D., Sudoi, R. K., Akhwale, W. S., Ndiritu, M., Hamer, D. H., Rowe, A. K., & Snow, R. W. (2011). The effect of mobile phone text-message reminders on Kenyan health workers' adherence to malaria treatment guidelines: A cluster randomised trial. *The Lancet*, 378(9793), 795–803. [https://doi.org/10.1016/S0140-6736\(11\)60783-6](https://doi.org/10.1016/S0140-6736(11)60783-6)