Challenges encountered with the use of mobile phones to deliver public health services in the Greater Accra Region of Ghana- A qualitative study

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Abstract

Background

The adoption and application of medical technologies is one of the six health system building blocks of the World Health Organization that ensures access and quality of health services for which the mobile phone is identified as a potential tool due to its general adoption and use by people, including healthcare providers. In spite of this there are some challenges that restrict the opportunities that the mobile phone technology could offer for delivery of public health services. This study explored the challenges encountered in the use of the mobile phone to deliver public health services in the Greater Accra Region of Ghana.

Methods

Qualitative research approach was employed in the study and data analysis done conducted with the use of NVIVO version 11 software package to facilitate thematic analysis of data.

Results

The key findings of the challenges encountered by healthcare providers in the provision of public health services comprised Management and leadership, Finance, Access, Infrastructure, Technical and Human resources.

Conclusions

The implication of this study is that despite the high adoption of the mobile phone by healthcare providers, there were also key challenges constraining the uptake of mHealth for public health services. A new analytical framework was developed to aid analysis of mHealth Challenges.

Background

The adoption and application of medical technologies is one of the six health system building blocks of the World Health Organization (WHO) that ensures access and quality of health services [1]. It is noted to positively influence global health systems for effective healthcare delivery [2]. Mobile health (mHealth) is a fast-emerging branch of electronic health (eHealth) which is the application of mobile and wireless technologies to deliver medical or public health services at a distance [3, 4]. This study focuses on the mobile phone for its global adoption [5]. It has been used to deliver various aspects of health services and increasingly being adopted by many countries [6]. Africa has seen modest rise as in other developing countries and the mobile phone has become an indispensable device for health services delivery [7]. The mobile phone consists of the hardware and software functions for which the former comprises all the

tangible parts while the latter includes all programmes and applications which help to operate the phone [8]. It is categorized into analogue and digital (smart); with the latter having more technologically superior features [9].

Evidence exists elsewhere and in Ghana that mobile phones are an appropriate tool for public health interventions in developing countries despite [10, 11, 12]. Safaie et al., [13] recommends its use for public health activities, especially for communicable diseases surveillance. Notwithstanding the positive role of the mobile phone for healthcare delivery, there is empirical evidence that this role is seriously constrained by a number of factors, particularly in Lower-and-Middle-Income Countries (LMICs). Mhealth challenges (barriers) affect healthcare providers' ability to leverage service delivery to clients.

Even though mobile telecommunication infrastructure has been greatly expanded to cover about 80% of the world's population, wide gaps still exist in access to these services, especially internet penetration in resource-constrained settings [14, 15]. Infrastructure is essential for the launch of mHealth services and its non-availability affects mobile penetration [16, 17]. Multiple languages constrain mHealth delivery and affect ability to send a standard set of information to people who have varied languages [18]. Lewis, Simons, & Fenning[19] reports that there are over 7,000 active languages in the world. This is a challenge despite internationalization of some languages as people still prefer receiving services in their local language (mother-tongue) [20, 21]. Language barrier inhibits the effective design and implementation of mHealth interventions, especially for LMICs and affects ability to reach all targeted population, coding of messages, trust and cost [22, 23, 24]. Illiteracy as a barrier refers to people without formal education. Empirical evidence shows that there are two types of illiteracy which are actual (natural) and digital. Actual illiteracy refers to those who did not attend formal education, while digital illiteracy refers to being technologically challenged or lacking the ability to understand and manipulate technological products irrespective of level of education [25]. This barrier particularly affects text-based (SMS) interventions and worsen the digital divide as well as general adoption of mHealth [23, 26]. There is however a strong relationship between actual illiteracy and digital illiteracy.

Security, safety and privacy have as challenge affect healthcare providers willingness to adopt mHealth products and services due to concerns with possible breach of confidentiality of clients records and data. They are important to maintain trust which is important in client-provider relationship [27, 28]. Cultural factors such as limited access by females to mobile phones in relation to male counterparts have been reported [16, 29, 30]. In some cultural settings, men controlled the mobile phones in the household which constrained their access to mHealth services for maternal services, which necessitated the involvement of male partners before mHealth services could reach the females [29]. Skaria [18] suggests that the more culturally diverse a population is, the more difficult it may be to design and implement mHealth interventions. Mechael et al. [23] therefore recommend a better understanding of context and culture to help develop effective mHealth interventions, especially in LMICs.

Cost as a barrier was reported by a significant section of literature [31, 32, 33, 34]. Cost was in the area of infrastructure, system set-up, communication and others. Most mHealth projects were mini pilots

('pilotitis') and cost was borne by foreign donors which masks actual cost of scale-up, affordability, affected interoperability and undermined sustainability [35].

Technical areas referred to mobile phone size, screen resolution, software processing capacity, freezing of phone, general phone complexity, etc. [16, 32, 36, 37]. These limit the phone's ability to handle big data such as large epidemiological data as more interventions are applied in the area of spatiotemporal data analysis [37]. Human limitations with the use of mobile phones have been empirically determined in the areas of slowing motor (motion), cognitive (mental) and sensory reflexes (visual, touch, auditory, etc.), especially among the elderly demography [32] who face more difficulty in handling new or complex information technology.

Other challenges identified from the literature as affecting adoption and use of mobile phones for mHealth were poor network availability, particularly for rural settings [15, 16, 39]. Lack of electricity supply and its stability [15, 26]; lack of awareness of mHealth services [39]; lack of convincing evidence to link mHealth and health outcomes [23, 40]. Staff attrition through transfers and others [41]; and perceived ease of use [42], medical staff resistance to technology adoption [17], among others. In Ghana, some of the specific challenges identified as constraining effective mHealth implementation are financing, infrastructure, disconnect between practitioners and the telecommunication companies, donor-driven mHealth projects, parallel mHealth programmes and electricity, among others [12, 43]. A survey of the literature reveals that there are numerous challenges (barriers) to mobile health. Even though not all challenges reported were found in the area of public health services, they are relevant for the study area. A survey of empirical literature reveals that there is no well-established analytical framework for describing or aiding effective analysis of all these numerous challenges. This current study was purposed to explores the challenges encountered with the use of the mobile phone to deliver public health services and thereafter developed a framework to aid analysis of mHealth challenges or barriers.

Methods

The research was set in an interpretivist-social constructionist worldview, with a qualitative approach. This approach explored lived experiences and obtained deeper insights from participants who have actually experienced the phenomenon. Thus, an interpretive phenomenological design was adopted to aid rich descriptions of lived experiences and meanings on the phenomenon within the context of respondents [44]. A purposive sampling technique was used to identify participants who had the knowledge and experiences to be able to provide in-depth opinions and insights on the phenomenon.

The research context was the public health care sector of the Greater Accra Region (GAR) of Ghana, with data collected from three purposively selected administrative enclaves (Metropolis, Municipality and District) using a semi-structured In-depth Interview (IDI) guide. The key technique for the IDI was based on initial question, probes and follow-up questions [45]. The target population comprised healthcare providers such as doctors, nurses, pharmacist, administrators, public health officers, community health workers and policy makers, among others; working at various levels of the Ghanaian public health system

in the GAR totaling forty (40) participants who were purposively selected and interviewed. The sample frame was more than that but at 40 participants, there were no new significant data generated as saturation was attained.

Fieldwork involved pretesting of instruments to help refine them for effective data collection in the Ga South District (with similar characteristics of the three selected sites) of the GAR to support instrumentation rigour and limit bias, among others. This was followed by actual fieldwork interviews. Interview duration ranged between 20 and 55 minutes based on respondent's depth of knowledge, experience(s) and available time. All the interviews were conducted in English Language. Consent form was administered for all interviewees for their express consent before interview and were assured of anonymity and confidentiality. Use of participant quotations were anonymized with codes and generic profession. Ethical Review approval was granted by the University of Ghana Ethical Review Board for Humanities. Raw voice data collected from IDIs were transcribed verbatim for inductive coding with the aid of NVIVO 11 software to determine emerging themes [45, 46]. Data analysis was based on Attride-Stirling's Thematic Network Analysis [47].

Results

Background characteristics of respondents

Participants background characteristics comprised areas of age, gender, academic and qualifications. Ownership of mobile phone were categorized into analogue or smart phone. Males were n = 29/40 and females were n = 11/40), with majority of respondents having work experience of more than 10 years. Twenty-one respondents (n = 21/40) had Master's qualifications and all respondents (n = 40/40) owned a phone; with n = 38/40 described as a smartphone. Refer to appendix for details.

Management and leadership challenges

The key management issue was the management of official mobile phones deployed for healthcare providers for provision mHealth. The issue of the deployment, management, maintenance and other operational issues of these official phones and other resources were identified as key management challenges. The scale of responsibility for management of these devices was a key concern.

"we need to find ways of controlling the devices so one of the things that we are coming up with is what we call MDMs (Mobile Device Managers) that will centrally manage the mobile devices...and then managing the device has been a challenge for us and then it increases the cost". (Public Health Doctor, 52 years, D9)

There was proliferation of mHealth projects that failed to go beyond completion (Projectitis-Pilotitis syndrome). These projects over-relied on foreign donor support to roll-out such activities with little or no coordination and integration with existing systems was a major challenge. Respondents noted that this syndrome affected financial and operational sustainability as most of the projects did not reach scale

after their completion. This phenomenon was described by respondents with words such as ‘multi-independent, ‘un-integrated’ and ‘small pilots’, among others. Few legacies if any were left with these mHealth projects, which affected sustainability.

“It was supported by a major financier. It was big. Currently, we don't have any legacy...it's not just piloting or using mobile phone for something but there's a whole lot of things that go with it. The approach, the methodology, the sustainability, the cost-effectiveness, the leadership...” (Health Information Technology Specialist, 40 years, B9)

“…most of the support that we’ve had is donor projects. So, when they end, if you are not careful, if during the implementation you’ve not thought about sustainability, when the project ends you will find yourself wanting”. (Nurse Educator, 35 years, B2C)

Financial challenges (Cost)

Financial Cost concerns all costs incurred in establishing mHealth, which constrained effective delivery of public health services. Researchers classified them into upstream and downstream costs even though some of the sub-themes appeared in both classifications. *Upstream cost* challenges concerned all initial financial outlay required before mHealth activities could be implemented while *Downstream costs* comprised financial challenges which emerged after implementation to ensure its continuous operations, maintenance and sustenance. Upstream costs included applications and software, infrastructure and mobile phone handsets. Application cost, comprised costs such as consultancy fees, Apps development including updates, licensing, security, support, among others.

“Technology is expensive if you are making a first initial investment...we have to spend money to get the infrastructure in place”. (Information Communication Technology Specialist, 47 years, B7)

“One is analysis fee...consultancy...storage, licensing, it depends on the kind of software that you are running. You have to take care of licensing…security… support”. (Data Manager, 34 years, A4)

“It was expensive getting the server”. (Health Information Technology Specialist, 40 years, B9)

Downstream costs were expenditure incurred to help maintain and keep operating systems, devices and equipment in maintainable state. Key maintenance and operating costs mentioned by healthcare providers included applications, software, system infrastructure and mobile phones. They ensured the continuous running of any installed application and its periodic upgrade and hosting. Others were maintaining internet connectivity and managing obsolescence.

“Technology is moving at a faster rate. Every day...there is a new software on the market. We have to be updating and taking into consideration most of the emerging issues in technology. We built a new e-learning platform...and it is now outmoded so we have to upgrade it. It’s like every time technology is moving on.” (Nurse Educator, 35 years, B2C)

“the cost of running the apps...that has been a challenge” (Public Health Doctor, 52 years, D9)

Communication cost as a downstream cost included the cost of credit units for voice, data, text and other communication, which were mostly borne by mHealth project finance and individual healthcare providers. These sources of funds were seen as not sustainable. The role of Telecommunication companies (Telcos) in supporting communication cost was noted as limited and based on corporate social responsibility requirements.

“people download the apps and they use their own data and then in that case, it means that if they don’t have data, they can’t access the app?” (Data Manager, 34 years, A4)

“And if there are no credits, you can’t do anything on the phone”. (Community Health Officer, 33 years, C9)

Phone cost was in the areas of cost of replacements due to misplacement, theft and maintenance of mobile phones.

“day in and day out people’s mobile phone gets missing and then being stolen...” (Disease Control Officer, 42 years C6A)

“...the whole issue of sustainability of...replacing the devices” (Public Health Doctor, 52 years, D9)

Access challenges

Illegal or unauthorized access to mobile phones were a challenge. Unauthorized access was identified to be physical or digital. Physical access referred to actual physical contact with the phone to access its data while digital access concerned remote access to stored information through hacking or cloning. This threatened security, privacy and confidentiality of both clients and healthcare providers’ data which could pose serious breach of trust, leading to medico-legal suits. This challenge was worsened by phone thefts, misplacement, left-unattended-to and sharing of phones with unauthorized people.

“the danger of somebody using his or her own phone especially for the health side is the confidentiality of data [health] sitting on personal phones which we think is not good enough. It poses challenges”. (Public Health Doctor, 52 years, D9)

“One of the core values are privacy and confidentiality of our patient information and also privacy of data on staff. We believe that certain information is classified, and so it shouldn’t come into public domain so whatever it takes to protect the data I think it should be done”. (Health Service Administrator, 42 years, C7A)

Infrastructure and system challenges

Infrastructure and system barriers encountered were the structures, equipment, organizational architecture and technological services required for effective and efficient mHealth services for public health services. Infrastructure and technological systems provided the backbone support for enabling mHealth. Any challenges therefore experienced with them could constrain mHealth effectiveness and resultant viability. The main barriers were network coverage and quality, electricity availability and

reliability and technological infrastructure, among others. Electricity unreliability were experienced particularly in the remote areas and affected ability to use the phone, inability to stay in touch with colleagues and carrying of battery back-ups which were a burden.

“And some places we don’t have electricity (very remote areas) so charging a phone is a problem. You have to come to the next place to be able to charge your phone”. (Public Health Specialist, 57 years, B8)

Technological Infrastructure concerned the provision of critical, physical and technological structures that needed to be in place to enhance mHealth by healthcare providers. This included fibre optic networks, special telemedicine infrastructure, Information Technology System, and mobile network system and coverage, among others. Provision of mobile network infrastructure in rural areas was a challenge, despite government incentives for Telcos. The poor investment in infrastructure in rural areas was due to lack of business opportunities for Telcos.

“Infrastructure is a lot very difficult to deal with…”. (Health Information Technology Specialist, 40 years, B9)

“The problem had always been how do… we in Ghana improve on our technology to enhance the use of telemedicine that is what has been the problem” (Policy Specialist, 57 years, B4)

Network Coverage and Quality as one of the Infrastructure and System challenges concerned all challenges relating to connectivity and reliability or quality of the network. Main issues included internet (availability, connectivity, speed, etc.), poor voice communication (call drops, signal weakness), network availability issues (network offline), general network unreliability, system faults and glitches, environmental factors (e.g. rain), among others. Healthcare providers were compelled to own multiple Subscriber Identification Modules (SIM cards) of different mobile companies due to this challenge.

“In our district the issue of network is a problem. There are some places when you go…the signal maybe very weak…you don’t get proper network”. (Medical Director, 52 years, C7C)

“Our internet services are not very reliable” (Nurse Manager, 55 years, C7B)

Technical challenges

Technical barriers comprised the mechanical, methodical, design and procedural issues surrounding the usage of mobile phones. The key issues raised were techno-technical which included the ease of operating equipment and mobile phones and inherent limitations in operating the above technological systems. These included battery power, limitation of the mobile phone in providing some aspects of healthcare, under-utilization of phone capacity and limited bandwidth of internet, mobile phone maintenance and one-way communication of mHealth messages (SMS).

“You will be talking to someone and then the battery will be going down”. (Public Health Specialist, 59 years, D2)

“We will be working with the phone then the keys will not be working…”. (Community Health Officer, 33 years, C9)

Human resource challenges

Human Resources concerned all people-related mHealth issues which included illiteracy, abuse, Job interference and stress, socio-culture and staff capacity. The others were availability and motivation and multiple languages, among others. All these factors were found to be barriers inhibiting effective public healthcare through the mobile phone. For example, illiteracy was a problem of the rural population rather than healthcare providers while multiple local Ghanaian languages necessitated the development of different packages of mHealth communication. Socio-cultural factors such as healthcare providers’ and clients’ attitude and mentally-ingrained habits affected mHealth activities. In spite of the convenience of mHealth services, some patients still wanted a face-to-face interaction with the doctor rather than through the mobile phone while healthcare providers had affinity for paper-based activities. The use of mobile phones at work was seen as causing interference and stress levels at the workplace as it interfered with healthcare providers’ normal work schedule and contributed to their stress levels. These barriers inhibited the delivery of public health services to the population.

“illiteracy is a big problem especially outside a lot of the urban areas”. (Innovation Specialist, 38 years B2A)

“when it comes to complicated things like sending WhatsApp messages, a lot of people cannot even send a text” (Telemedicine Specialist, 39 years, D1C)

“if you are a volunteer, at least you are supposed to speak two or three languages…It’s about the language”. (Community Health Volunteer, 26 years, C10B).

“The average patient will want to have a one-on-one, eyeball-to-eyeball meet with a physician, either a doctor or a nurse…in the mind of people, you don't want them to go to the hospital.” (Information Communication Technology Specialist, 47 years, B7)

Discussions

This study found that the challenge of managing large official phones was a daunting task for healthcare managers which was not taken into consideration when planning for mHealth activities. This was a unique finding of the study for which policy makers and financiers of mHealth must include in their planning and design of mHealth as it could have extra cost and administrative implications. The phenomenon of mHealth proliferation as reported in the literature as ‘Pilotitis syndrome’ was also among the findings of the study. This resulted in escalated cost, lack of coordination, non-interoperability of systems and inability to scale-up mHealth services after projects ended. In addition to the findings of literature, researchers also found a ‘Projectitis sydrome’ to further describe the challenge of ineffective mHealth proliferation. To help resolve the challenges of ‘Projectitis-Pilotitis syndrome’, policy makers should strengthen the regulatory and policy environment for mHealth aimed at aligning mHealth projects

into existing structures and move beyond projects to actual scale-up and integration into existing healthcare systems. One effect of this syndrome is that it created two systems of mHealth-formal and informal. The formal mHealth comprised all the well-established mHealth projects which had form and structure, with clear objectives and expected outcomes. The other comprised use of the mobile phone to perform mHealth services out of exigencies and not under any centrally-controlled direction or mandate. This presents two mHealth streams with the informal being the largest. This has implications for scale-up and limits the extent to which the opportunities offered by mHealth can be maximized.

The findings on costs generally confirm that of literature, however this study improved on cost analyses by categorizing them into *Upstream* costs (incurred before mHealth implementation) and *Downstream* costs (incurred after mHealth implementation) to aid a better appreciation of mHealth cost structure. Upstream costs included applications and software, infrastructure and mobile phone handsets while Downstream costs ensure its continuity in operations, maintenance and sustenance. This study finds similar concerns in the literature [48] with privacy, security and confidentiality arising from illegal or unauthorized access to mobile phones of healthcare providers. This study found extra sources of privacy and security concerns such as stealing and misplacement of phones by healthcare providers. It was acknowledged that such breaches cause serious breach of trust between providers and clients and may have medico-legal implications. The threat of fake (junk) news is worsened by such breaches which effect trust in mHealth services as hackers could send unverified messages from seemingly trusted sources.

The study shows that wireless data access in rural areas was poor, especially for fast internet. This confirms literature which posits that infrastructure has seen growth over the years but there still exist access gaps, particularly for data in rural and poor settings [14, 15, 16, 49]. This might constrain mHealth services as data is essential for digital learning and using all non-analogue platforms. Just as literature mentions multiplicity of languages as a challenge for delivery of mHealth services, which affects the distribution of a standard set of information to target populations and design of mHealth [18]; the study also noted that language was a challenge for delivering of mHealth services during communication with clients. The language challenge was noted more in the rural and peripheral setting and experienced more by first-line healthcare providers. It was therefore necessary that healthcare providers were bilingual or had a team member having the ability to speak native languages of the communities. Illiteracy was not a challenge among healthcare providers as they were all educated and also had high digital capabilities and literacy. Actual illiteracy was reported as a problem among rural folk, which affected effective mHealth services to them, especially when it came to social media and digitally-based communication. The strong affinity for paper-based services by healthcare providers and emotional need for touch by clients may be attitudinal rather than a socio-cultural factor.

Conclusions

The study explored the challenges encountered in the use of the mobile phone to deliver public health services in the GAR. It reveals a high adoption of the mobile phone technology among healthcare

providers. It contributes to empirical knowledge by providing original in-depth perspectives on mHealth in public health services and thus extends knowledge in this nascent field, particularly in a developing country context such as Ghana. It strengthens mHealth policy analysis with the development of an analytical framework to aid analysis of challenges of mHealth. Study shows that mHealth in public health services faces a number of challenges. One key contribution of this study is the development of a framework to aid analysis of mHealth challenges using the first letters of the inductively developed themes, which were then rearranged to form an acronym called MFAITH. All challenges categorized in the areas of Management, Financial, Access, Infrastructure, Technical and Human resources are to be placed in their respective frames, which help simplify the analysis of the challenges. This results in the *MFAITH Framework* as named by the Researchers.

The study's key limitation was that it only focused on the provider-side (supply-side) challenges to the exclusion of the client-side (demand-side). Study only covered participants selected in three sites in one of the sixteen regions of Ghana. Future research can look at these options to help extend the empirical frontier of mHealth. Policy makers may use the newly developed MFAITH Framework to guide a comprehensive assessment of the challenges confronting their mHealth interventions for informed policy decisions for effective management of mHealth for public health services in the GAR of Ghana.

Abbreviations

eHealth- Electronic Health

FGD- Focus Group Discussions

GAR- Greater Accra Region

ICT- Information Communication Technology WHO- World Health Organization

IDI- In-depth Interview

ITU- International Telecommunications Union

LMICs- Lower-and-Middle-Income Countries

MFAITH- Management, Financial, Access, Infrastructure, Technical, Human Resources

mHealth- Mobile Health

Declarations

Availability of data and materials

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethical review was granted by the University of Ghana Ethical Review Board for the Humanities with approval Number ECH 107/16-17 and Institutional approval and permissions from the Ghana Health Service. Verbal and written consent were sought from all interviewees before interviews were conducted.

Consent for publication

Not applicable

Availability of data and materials

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request

Competing interest

The authors declare that they have no competing interests.

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Authors' contributions

1. **AEH** - Designed the study and collected data from the field; conducted qualitative data analysis and drafted the initial manuscript.
2. **PAA** - Reviewed the study design and protocols; oversaw data collection and reviewed manuscript for relevant quality assurance.
3. **AAA** - Reviewed manuscript for relevant quality assurance
4. **FAA** - Reviewed manuscript for relevant quality assurance

All authors read and approved the final manuscript for submission

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Figures

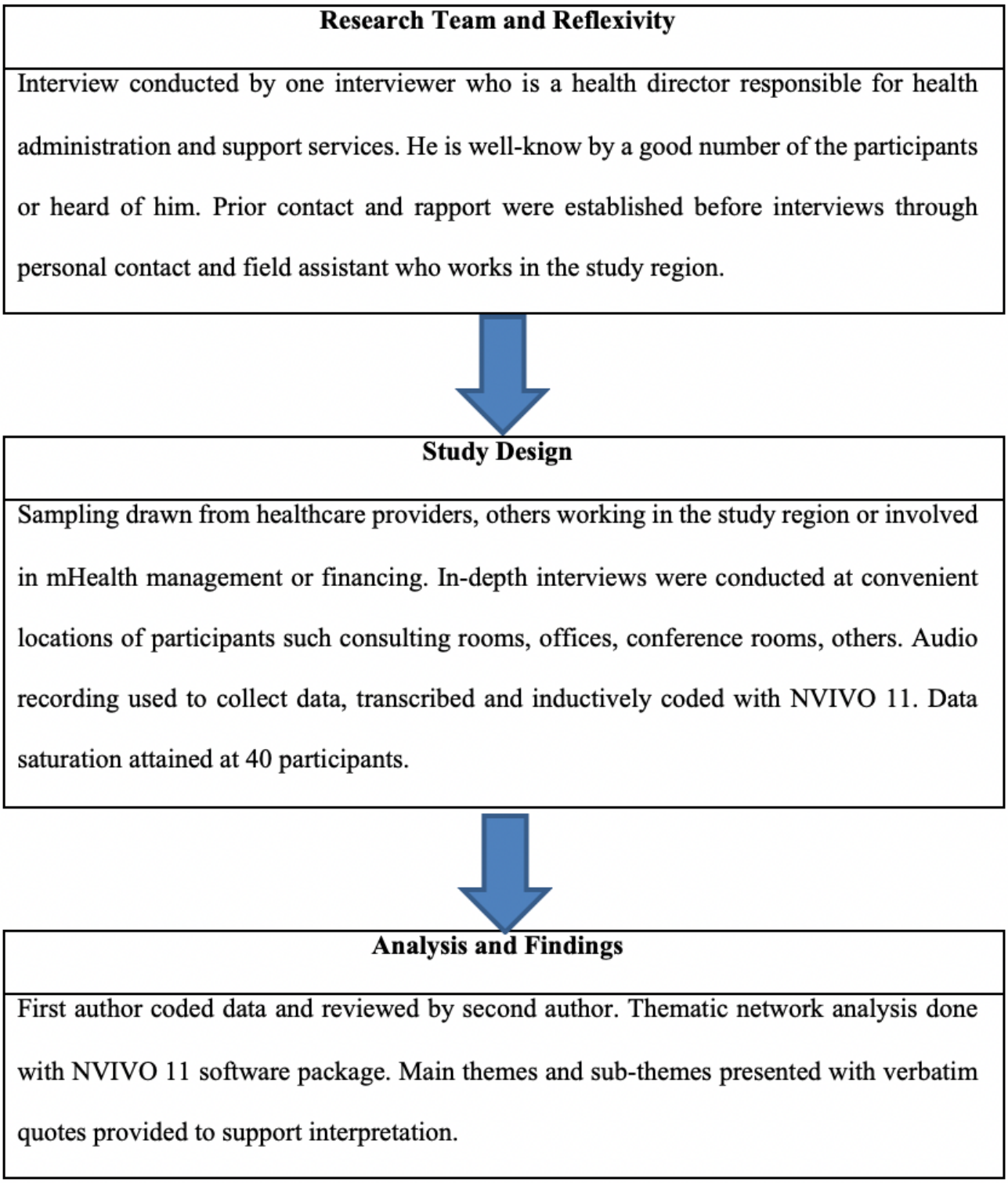

Figure 1

COREQ FLOWCHART

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