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Original Research

An investigation of users' attitudes, requirements and willingness to use mobile phone-based interactive voice response systems for seeking healthcare in Ghana: a qualitative study

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ABSTRACT

Objectives: In implementing mobile health interventions, user requirements and willingness to use are among the most crucial concerns for success of the investigation and have only rarely been examined in sub-Saharan Africa. This study aimed to specify the requirements of caregivers of children in order to use a symptom-based interactive voice response (IVR) system for seeking healthcare. This included (i) the investigation of attitudes towards mobile phone use and user experiences and (ii) the assessment of facilitators and challenges to use the IVR system.

Study design: This is a population-based cross-sectional study.

Methods: Four qualitative focus group discussions were conducted in peri-urban and rural towns in Shai Osudoku and Ga West district, as well as in Tema- and Accra Metropolitan Assembly. Participants included male and female caregivers of at least one child between 0 and 10 years of age. A qualitative content analysis was conducted for data analysis.

Results: Participants showed a positive attitude towards the use of mobile phones for seeking healthcare. While no previous experience in using IVR for health information was reported, the majority of participants stated that it offers a huge advantage for improvement in health performance. Barriers to IVR use included concerns about costs, lack of familiarly with the technology, social barriers such as lack of human interaction and infrastructural challenges. The establishment of a toll-free number as well as training prior to IVR system was discussed for recommendation.

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Conclusions: This study suggests that caregivers in the socio-economic environment of Ghana are interested and willing to use mobile phone-based IVR to receive health information for child healthcare. Important identified users' needs should be considered by health programme implementers and policy makers to help facilitate the development and implementation of IVR systems in the field of seeking healthcare.

Introduction

Health systems in low- and middle-income countries continue to face challenges in providing free access to high-quality healthcare and thus increasing the urgent need for innovative approaches to overcome existing shortcomings.[1,2] In response, the application of mobile technology in the health sector has experienced mounting interest as a consequence of an unpredicted increase of not only cell phone user rates and network coverage in developing countries but also a rapid mobile technological advancement and falling market prices.[1,3,4] As a result of this powerful combination of favourable factors, the application of mobile devices in the health sector (known as mHealth; a subset of electronic health [ehealth]) has the potential to overcome geographical and financial barriers and can serve as an access point to national health information and disease surveillance systems.[5] Additionally, it offers an effective contribution to public health initiatives in support of achieving the health-related Millennium Development Goals post-2015 era while being economical, effective and sustainable. The mHealth initiatives are designed to improve communication between individuals, emergency care, health monitoring and surveillance as well as access to information by healthcare professionals at point of care.[5] Systematic evidence of the benefits of some specific mHealth approaches such as patient-targeted text messaging for health information and behaviour change already exists.[6–8] Although less popular than text messages to facilitate care at a distance, automated telephone calls with recorded messages, called interactive voice response (IVR) has shown great potential for use in the field of healthcare.[9] IVR application in mHealth allows for an efficient exchange of information to or from a database and is a way of patient communication that has increasing utility to disseminate life-saving health information in remote areas. So far, it has been successfully used in a variety of applications ranking from preventive services utilization,[10] diagnosis and management of disorders and chronic diseases[11–13] to health behaviours measure.[14] In Ghana a national eHealth strategy was launched in 2010 in order to make best use of existing capacity and to provide a foundation for investment and innovation.[15] Since then more than 20 pilot projects have been implemented across the country.[16] Although the level of mHealth activities in Ghana is growing significantly, the temptation is to transfer technology without any considerations for local needs, and evaluation of activities continue to be very low.[16] In order to guarantee successful nationwide scale-ups and large-scale programming, a consideration of implementation barriers has to be anticipated, appropriate measures taken to identify such barriers and strategies to overcome the barriers well fashioned into the scale-up programmes.[5,16] It is known from technology acceptance research that user perceptions, adherence and acceptance may constitute the key barriers or indictors for successful development and implementation of mHealth technologies[5,17,18] and becomes of particular importance when applying approaches in highly sensitive healthcare settings.[19] The general objective of the present study was to explore users' needs and requirements to use mobile phone-based IVR systems for seeking healthcare. This included the assessment of (i) the attitudes towards mobile phone use and user behaviour/experiences as well as (ii) the identification of facilitators and barriers to use mobile phone-based IVR technology in two rural and two urban sociocultural settings in Ghana.

Methods

The qualitative data used for this study were part of a larger project that developed a mobile phone-based electronic health information and surveillance system (eHISS) for child health to be piloted in the Asante Akim North Municipal of the Ashanti Region of Ghana. eHISS aimed to (i) support parents of sick children to assess the disease severity and to advise appropriate treatment and (ii) collect data on the occurrence of symptom clusters. Therefore an interactive voice response system was established, which caregivers of ill children could call. Based on a set of questions to respond, tailored feedback with specific health advice was provided at the end of each call.

Study site and sampling

Four qualitative semistructured focus group discussions (FGDs) were conducted to allow for both detailed and direct assessment of subjective perceptions of study participants. A mixed sampling technique was applied which was composed of different steps stratified in a random and purposeful manner (Fig. 1). Four out of 10 districts of Greater Accra Region were selected as study sites; Accra Metropolitan and Tema Metropolitan as urban centres and Shai Osudoku Municipal and Ga West Municipal as rural counterparts. Accra and Tema Metropolitan assemblies have estimated total populations of 1,848,614 and 402,637 respectively.[20] Furthermore, Shai Osudoku and Ga West Municipal assemblies have an estimated population of 122,836 and 262,742 respectively.[20] Out of the selected districts, two peri-rural subdistricts, Ayikuma and Teiman, and two peri-urban subdistricts, Tema Community 5 and Kokomlemle, were selected on the basis of demographics to ensure a representative sample with respect to urban and

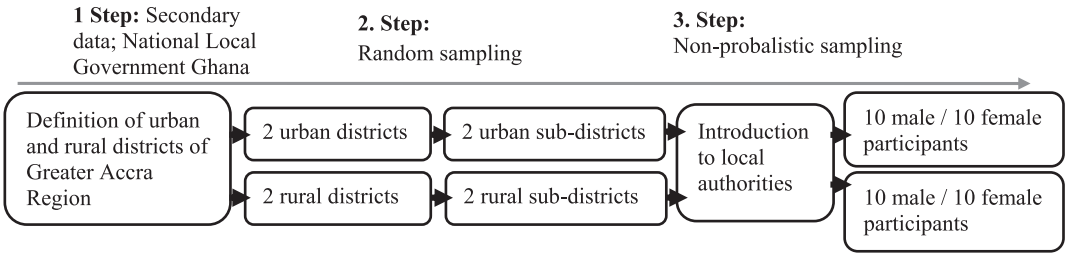

Fig. 1 – Sampling scheme.

rural development. In each district, a meeting with the community assembly member was arranged and FGDs were designed and organized accordingly. One FGD with 9–11 participants was conducted in each site. FGDs were conducted between October and November 2014 and consisted of homogenous male and female groups.

Data collection

Each FGD happened in two sections; the first section consisted of the completion of a short standardized questionnaire with sociodemographics and basic information relating to ownership and utilization of mobile phones. The second section consisted of a discussion that followed an FGD guide which was split in two sections consisting of questions relating to (i) the general attitude towards and significance of mobile phones use in everyday life as well as applications used and information received and (ii) participants' perspectives, concerns and willingness to use health information sourced from IVR system. Before the second section was discussed, participants had the opportunity to try the prototype of the eHISS IVR system for seeking healthcare on their personal mobile phones. FGDs took place in the meeting rooms of district centres and were carried out by one moderator and one trained research assistant who also recorded field notes on group interactions. Discussions were conducted in Twi with simultaneous translation into English language. Interviews were audiotaped and transcribed by using the software program f4 [Dr. Dresing & Pehl GmbH, Marburg] following the programmer's transcription conventions. Systematic procedures were applied to guarantee reliability and validity during the data collection process, including a debriefing session between the moderator and assistant moderator after each group, and the use of field notes and audio transcripts.

Data analysis

Data were analysed applying a qualitative content analysis in accordance with Mayring's approach which is distinct from other quantitative approaches, as it provides the possibility of quantification of qualitative results through a stepwise analysis.[21] Based upon the research questions, the transcript of the FGDs was analysed by stepwise construction of categories for coding. First, categories were deductive adapted in accordance with existing theories, namely the ABC model of attitude and the Unified Theory of Acceptance and Use of Technology (UTAUT). This was followed by, second, inductive development of subcategories and Likert scales. Third, categories were revised and completed step by step during coding (Fig. 2). Reliability of findings was assessed by following the recommendations of Lombard et al.;[22] two authors coded the FGDs independently before one person who had been involved in neither the analysis nor construction of coding was given a random sample of 20% of the scripts, which had been coded. Following differences in coding were discussed between the researchers until agreement was reached. Percentage of agreement was calculated for intercoder reliability measure.

Results

Characteristics of study participants

A total of 40 participants were involved in the FGDs, of which 21 were female and 19 were male. All were Ghanaians and caregivers of at least one child between 0 and 10 years. The age of participants varied between 18 and 59 years with a median of 35 years among women and 37 years among men. The majority of participants belonged to the Ga/Dangme ethic group and were married or lived together with their partners (Table 1). Half of the study participants ($n = 20$; 50.0%) needed assistance in filling out the questionnaire because they were not literate, and a total of $n = 4$ participants had participated in a literacy programme. The majority of participants ($n = 33$; 82.5%) stated to visit governmental hospitals/polyclinics for healthcare in case their child gets sick, whereas others preferred private clinics ($n = 4$; 10%) and governmental health centres ($n = 33$, 82.5%) for seeking healthcare.

Participant's attitudes towards use of mobile phones

All participants expressed 'very positive' or 'positive' feeling about the use of mobile phones—for instance mobiles were described as 'friends' which are 'good' and of 'tremendous help and importance'. Furthermore it was stated that mobile phones play a key role in social life and were perceived as either 'very important' or 'important'.

> *Mobile phones have helped me in particular in many ways and my phone has a very important role in my everyday life* (female FGD participant, urban area)
> *My mobile phone is my friend* (female FGD participant, rural area)
> *Mobile phones have been of tremendous help and importance* (male FGD participant, urban area)

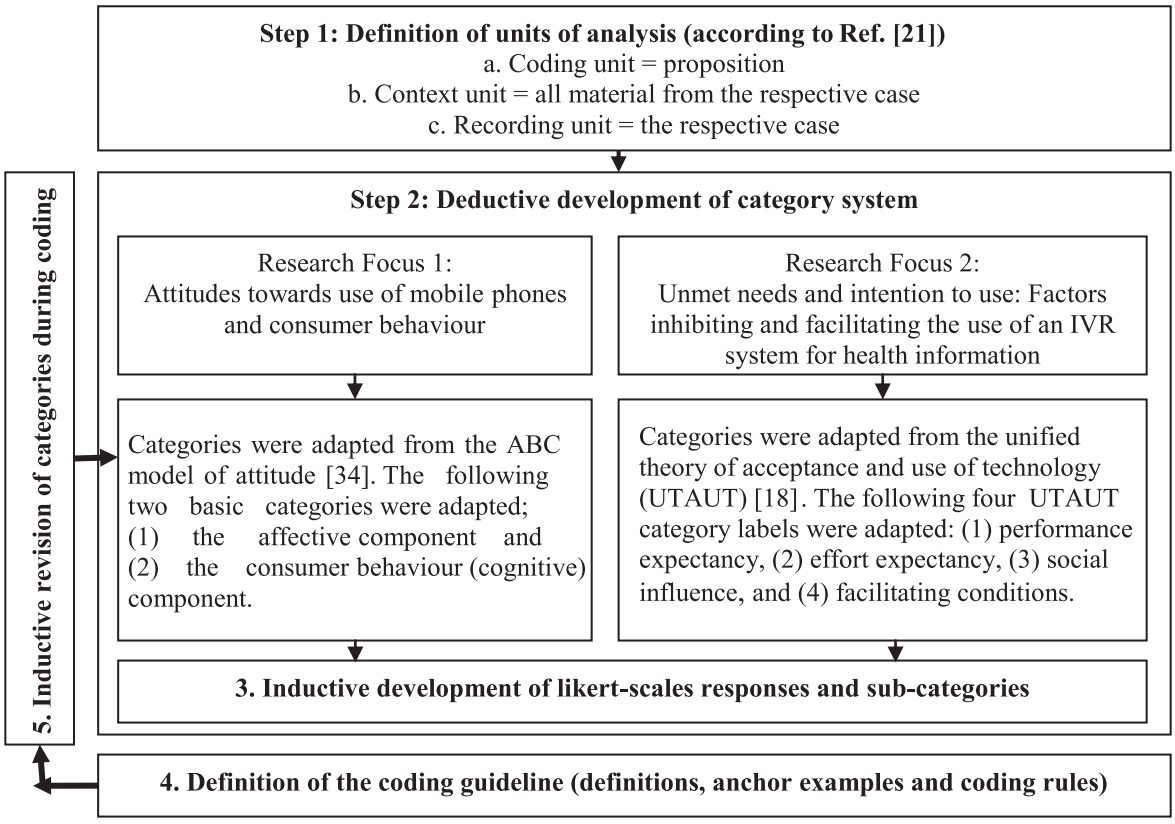

Fig. 2 – Step-by-step model for the FGDs content analysis. Mayring P. Qualitative Inhaltsanalyse: Grundlagen und Techniken (Qualitative content analysis. Basics and methods), vol. 11. Weinheim: Beltz; 2010 [21,34].

More than 90% of study participants ($n = 37$; 92.5%) have been using mobile phones for over three years and almost all participants ($n = 39$; 97.5%) reported to use their phone on a daily basis, except one female participant living in one of the rural study sites who reported to use the phone weekly. Only two participants ($n = 2$; 5.0%) shared their mobile phone with somebody, and a quarter of participants ($n = 10$; 25%) owned more than one cell phone. Participants claimed to use their phones on a daily basis for many purposes, including social networks, education, employment, leisure time, security and emergency cases, and business. Forty percent ($n = 16$; 40%) of the study participants stated they have received public health messages on their mobile phones. Experiences included received health information via short message provided by network communication companies with the opportunity to register for free daily health advices as well as offered health insurance products as additional value-added services from mobile companies.

> *Most of the time we receive [health] information from our network providers (...). We receive text messages about Ebola, they inform us how to take care of yourself and it won't spread* (male FGD participant, urban area)
>
> *(...) like Ebola information. They provide a number that I should text if I want to receive daily tips, I should text to know more* (male FGD participant, rural area)
>
> *Yesterday I had a health message that lemon is very good taking away toxins from my body. Everyday I have health information from my network provider because I accessed it, I registered* (female FGD participant, urban area)
>
> *[We receive] messages about health insurance from the network provider. After you have been discharged you send the receipt [of the hospital] and they will pay a certain amount to you* (male FGD participant, rural area)
>
> *The station gave me [a] message to register myself for [health] insurance. So I registered myself and my children* (female FGD participant, rural area)

Interactive voice response (IVR) technology was well known among study participants because mobile phone companies in Ghana installed IVR systems for prepaid and postpaid customers to entire products through a unified short code. However, none of the participants had ever called an IVR system to receive health information. In this context, the need of a toll-free service was discussed as a basic to make an IVR system for seeking healthcare work and a few participants further mentioned that they were sceptical towards the use of IVR systems because of wasting too much credit.

User requirements and intention to use IVR to receive health information

Overall, participants expressed great interest in using an IVR system for healthcare-seeking behaviour and stated that it will be 'very helpful' or 'helpful' to promote good health at individual level (Table 2). Identified individual advantages in

Table 1 – Sociodemographic characteristics of study participants ($n = 40$).

Characteristics	Focus group discussions ($n = 40$)							
	Urban				Rural			
	Male		Female		Male		Female	
Age (years)								
[Mean (SD)]	39.6 (±7)		34.3 (±15)		40.2 (±12)		35.7 (±9)	
	N	%	N	%	N	%	N	%
Ethic group								
Akan	2	5.0	4	10.0	/	/	/	/
Ga/Dangme	1	2.5	5	12.5	10	25.0	1	2.5
Ewe	5	12.5	/	/	/	/	10	25.0
Other	1	2.5	1	2.5	/	/	/	/
Marital status								
Married/living together	7	17.5	6	15.0	10	25.0	3	7.5
Divorced	1	2.5	2	5.0	/	/	5	12.5
Widowed	/	/	/	/	/	/	1	2.5
Never been married or living together	1	2.5	1	2.5	/	/	2	5.0
Education								
None	/	/	/	/	1	2.5	3	7.5
Primary	/	/	1	2.5	1	2.5	3	7.5
Junior/JSS	3	7.5	6	15.0	6	15.0	5	12.5
Senior/SSS or higher	6	15.0	3	7.2	2	5.0	/	/
Children/age between 0 and 10 years								
1 or 2	5	12.5	5	12.5	4	10.0	2	5.0
3 or 4	3	7.5	4	10.0	1	2.5	7	17.5
More then 4	1	2.5	1	2.5	5	12.5	2	5.0
Subtotal (n)	9	22.5	10	25.0	10	25.0	11	27.5

SD, standard deviation; JSS, junior secondary school; SSS, senior secondary school.

using IVR to receive health information included saved time, improved access to health information and reduced costs not only for medical advices but also for travel. The introduction of an IVR health information system in the community may furthermore improve the image of the community and may contribute to capacity building (Table 3). Another factor reported to influence the intention to use IVR was the ease of use of the technology. The degree of ease associated with the presented system varied between 'easy' and 'not easy.' Reported challenges included difficulties in operating the smart phone and current lack of familiarity with IVR technology in general (Table 2). For instance, participants needed more time than anticipated to press the keys on their phone and in some cases, the IVR system went too fast before participants were able to bring their phone back close to the ear in order to listen to further instructions. Furthermore some participants who used a smart phone with touch screen faced technical challenges, i.e. once they were connected to the call, the numeric keypad disappeared and they did not know how to return to the screen to its original settings in order to navigate the IVR system. Further reported barriers to IVR use were related to social barriers such as the lack of human interaction and fear that health problems may be too complex to be addressed by information received through an automatic voice response (Table 3). Advocates for the introduction of the system requested that the system should be introduced in the community and provision of tailor-made training to improve familiarity with IVR technology. This would be of particular importance in order to make the IVR system available for illiterate people and people with special abilities/needs.

> *A lot of people (…) don't know anything apart from receiving and calling. Maybe they cannot even write their name. What are you doing about them?* (female FGD participant, rural area)

The importance of social influence and publicity was further identified as important construct influencing the intention to use (Table 2). Participants reported that it would be of high importance to have an automated voice in the system of somebody familiar to the community as this would

Table 2 – Constructs influencing behaviour/intention to use mobile phone-based IVR to receive health information.

Constructs[a]	Definition[b]	Category[c]	N	%	α
Performance expectancy	The degree to which an individual believes that using the system will help to attain advantage in individual health performance	Very helpful	14	61	0.97
		Helpful	9	39	
		Less/not helpful	0	0	
		Total	23	100	
Effort expectancy	The degree of ease associated with the use of the system	Very easy	0	0	0.92
		Easy	15	71	
		Less easy	2	10	
		Not easy	4	19	
		Total	21	100	
Social influence	The degree to which an individual perceives the importance of other opinions/importance of assembly members/importance of publicity	Very important	5	63	0.90
		Important	3	37	
		Less/not important	0	0	
		Total	8	100	
Facilitating conditions	The degree to which an individual thinks that an organizational and technical infrastructure exists to support use of the system	Not a barrier	0	0	0.87
		Moderate barrier	6	67	
		Extreme barrier	3	33	
		Total	9	100	

[a] Identified deductive dimensions in accordance with UTAUT.
[b] Adapted from Venkatesh et al., 2003 [18].
[c] Inductive developed Likert scales. Total number is equivalent to participants who discussed the construct during the FGDs; α = intercoder reliability calculated according to percent of agreement/Holsti method.

Table 3 – Facilitators and barriers for using mobile phone-based IVR technology and recommendations for implementation.

	Reported theme	Intercoder reliability
	N	α
Facilitators		
For patients		
Save time	13	0.92
Increase access to health information	10	0.97
Reduce costs (transport costs/costs for medical advice)	18	0.85
For communities		
Capacity building	6	0.97
Improve image of community	4	0.82
Barriers		
Infrastructural barriers		
Concerns about lack of network availability	16	0.87
Concerns about power shortages and battery dying	19	0.90
Technical challenges		
Challenges in operating the phone	8	0.92
Concerns about learning to use technology/lack of familiarity with technology	16	0.95
Social barriers and others		
Concerns about lack of human interaction	4	0.87
Concerns about costs	7	0.90
Health problems too complex	5	0.97
Recommendations		
Provide training on device use	17	0.97
Include community health workers for support/employ information technology support stuff	16	0.85
IVR system should be introduced to the community by a community assembly member	5	0.97
Provide the possibility to choose between local languages	12	0.92
Provide toll-free number	16	0.97

α = intercoder reliability calculated according to percent of agreement/Holsti method.

greatly increase the trust in information. Stated examples of such personalities were assembly members or community health workers. Furthermore, the system should be available in the local languages (Table 3).

> *In this community we have opinion leaders and elders who should introduce the system to the community. We can also use assembly members for announcement* (female FGD participant, rural area)
>
> *We have the major languages that are acceptable in Ghana and used as a medium for communication within Ghana. So let's look at these languages and let's use the major languages which are suitable for radio in Ghana for the [IVR] system* (male FGD participant, urban area)

Organizational and technical infrastructure was further stated as an important factor to adequately using the IVR system and was discussed as a moderate or extreme barrier to using the mobile phone-based IVR health information system in Ghana (Table 2). Participants cited the lack of network availability and power shortages in the country as examples of infrastructural barriers to the implementation (Table 3). Intercoder reliability of defined categories was tested applying percentage of agreement and showed very good results rating between 0.82% and 100% intercoder reliability.

Discussion

The present study aimed to examine users' requirements in order to use a mobile phone-based IVR system for seeking healthcare. First, (i) attitudes towards the use of mobile phones among caregivers of children were identified, before (ii) a prototype of an IVR system was tested and challenges and facilitators to use were assessed. Evidence shows that interactive voice response-based interventions have so far proven to be a convenient, inexpensive and reliable method in mobile healthcare. For instance, IVR has been studied in low- and middle-income countries for remote education of community health workers, e.g. in the field of health of family planning,[23] for diagnostic and treatment support,[24] to promote medical adherence,[25] as monitoring and self-care education tool for depressed patients,[26] and to improve knowledge, attitudes and behaviours towards sexually transmitted infections.[27] In Ghana although around 20 electronic health projects have been implemented,[16] only one study focused on the application of mobile phone-based health educational voice messages to study health-seeking behaviour.[28] To our knowledge, our study is the first to investigate the use of an IVR system for seeking healthcare for childhood diseases by ascertaining caregivers' attitudes, motivations for adoption and barriers to its implementation. Results revealed that mobile phones have an important role in everyday life of participants and a generally positive feeling towards the use of mobile phones to seek health information was reported. Participants trusted and used the device for several purposes and no critical points, such as data security was of concern to participants. As mobile technology catches up in Ghana[29] coming along with the possibility to deploy community-wide mHealth systems, it is important to understand the impact of users attitudes towards mobile phones, and how those influence behaviour and the intention to use mHealth tools. The World Health Organization points out that the success of mHealth depends significantly on consumer acceptance[5] and research has proven that the attitude towards devices has an important role in explaining consumer behaviour and technology acceptance.[19] For analysis of FGDs qualitative content analysis in accordance with Mayring (2010) was applied in order to utilize a procedure of systematic text analysis which preserves the strengths of content analysis, and at the same time, ensures methodological control by clearly defining steps of interpretation. Mayring's approach is one of the most established methodologies in German-speaking countries of Europe[21] and allows not only a stepwise text analyses but also a quantitative analysis of results in case of satisfying intercoder realibility.[21] During stepwise analysis of the FGDs and coding of text material, constructs known from technology acceptance models were identified. Accordingly categories influencing the intention to

use a new technology were assessed deductive in accordance with the UTAUT formulated by Venkatesh and others.[18] UTAUT was developed based on the comparison of eight technology acceptance theories, and identified four constructs influencing technology acceptance, namely: (1) performance expectancy; (2) effort expectancy; (3) social influence; and (4) facilitating conditions.[18,30] All four determinants validated by UTAUT were independently mentioned and discussed by FGD participants. For instance, participants found the IVR system not only helpful to attain advantages in health performance ('performance expectancy') but also discussed the ease of use as an important factor for regular use of the system ('effort expectancy'). Further, opinions from persons of influence, such as community leaders or assembly members, were discussed to impact the intention-to-use ('social influence') as well as the organizational and technical infrastructure of the country ('facilitating conditions'). This may indicate that UTAUT is an appreciated model for predicting and explaining the intention to adopt IVR systems for seeking healthcare in the Greater Accra region in Ghana. However, we did not correlate the constructs with sociodemographic variables or measure the impact of determinants on behaviour intention to use IVR technology as this was beyond the scope of the feasibility study. Further investigation and research is needed to test and confirm the efficiency of UTAUT variables to predict acceptance and use of IVR technology for mobile phone-based healthcare. The detailed assessment of factors which are still needed for regular use of the system (barriers to use) included not only infrastructural and technical challenges such as lack of network availability, power shortages and challenges in operating the phone/or system but also social barriers such as the absence of human interaction or concerns about costs. These findings are consistent with previous studies on the acceptance of mHealth application tools among healthcare providers and communities.[31–33] The financial aspect of IVR interventions and mHealth programmes in general are crucial not only for users but also for stakeholders. Whereas the low costs of technologies demonstrate one reason for the success of mHealth, the unclear healthcare responsibility and the dependency on funding going in line with it are two of the main challenges for sustainable implementation.[17] To achieve long-term impact of applications, partnerships for support and sustainability, such as governmental grants, and/or financial contributions from private companies or donor organizations, need to be discussed in order to determine how a system can be scaled up from a pilot to national level. In spite of the high methodological rigour of our study combining qualitative and quantitative methods, some limitations were inevitable. Results are qualitative data based on a small sample size and are not intended to be representative for the entire population in the Greater Accra region and, therefore, are at risk of selection bias. Further, we collected basic sociodemographic data to provide an overview about study population characteristics but did not correlate those variables because of the small sample size. The transcripts of FGDs were analysed step by step following an analysis model, the text material was divided into content analytical units with categories in the centre of analysis, and criteria of reliability and validity applied thereby ensuring good intercoder reliability which was tested according to the recommendations of Lombard, Snyder-Duch and Bracken.[22] The appropriate minimum acceptable level of reliability for categories was fixed at 0.80 or greater for our analysis and we reached excellent intercoder reliability for all categories. However, the applied Holsti's method for calculation has limitations as it only calculated the percent of agreement between coders and is known to be sensitive for bias.[22]

Conclusion

The present study provides new insights about users' requirements to use IVR technology for seeking healthcare in a setting with profound penetration of mobile telephony. It provides valuable impulses for research as well as policy and practice. First, the results contribute to the limited literature on mHealth in sub-Saharan Africa and highlight users' needs and barriers for the regular use of IVR systems. Further research is needed to provide a deeper understanding of IVR acceptance among a largely illiterate population and older adults in order to give further insights on how to overcome the identified implementation barriers. Moreover, the results of the present study indicate that the UTAUT model consists of adequate determinants to measure IVR acceptance in low- and middle-income settings. Therefore, we suggest that future research should be conducted to validate the model in the socio-economic environment of urban and rural areas in low- and middle-income countries. Second, we experienced a high grade of fragmentation and lack of standards within the interdisciplinary field of mHealth. We therefore highly support the development of initiatives to build confidence in and acceptance of mHealth services. This includes not only the development of evidence-based recommendations and guidelines for mHealth implementation in sub-Saharan Africa but also an increasing focus on campaigns promoting awareness, confidence and acceptance of new technologies by users, including not only patients but also stakeholders. In our opinion, the combination of both factors, the development of best practice for mHealth implementation which include and/or recommend user-centred designs would greatly help to distinguish the full potential of mHealth in low- and middle-income settings.

Authors statements

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Ethical approval

The Committee on Human Research, Publications and Ethics, School of Medical Science, Kwame Nkrumah University of Science and Technology, in Kumasi, Ghana, approved the study design and informed consent procedures in the underlying studies.

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Competing interests

None declared.

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