Implementing a Hospital Call Center Service for Mental Health in Uganda: A Qualitative Formative Study

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Abstract

Background: Mental health conditions are a significant public health problem globally, responsible for over 8 million deaths per year. They also lead to lost productivity, exacerbate physical illness, and people with mental health problems suffer stigma and human rights violations. Uganda, like many low- and middle-income countries (LMICs), faces a massive treatment gap for mental health conditions, and numerous sociocultural challenges exacerbate the burden of mental health conditions.

Objective: To describe the development and formative evaluation of a digital health intervention for improving access to mental healthcare in Uganda.

Methods: This was a qualitative study employing principles of user-centered design and design science research. Stakeholders, including patients, caregivers, mental healthcare providers, and implementation experts (N=65), participated in focus group discussions in which we explored participants' experience of mental illness and mental healthcare, experience with digital interventions, and opinions about a proposed digital mental health service. Data was analyzed using the consolidated framework for implementation research to derive requirements for the digital solution, which was iteratively co-created with users.

Results: Several challenges were identified, including a severe shortage of mental health facilities, unmet mental health information needs, heavy burden of caregiving, financial challenges, stigma, and negative beliefs related to mental health. Participants' enthusiasm about digital solutions as feasible, acceptable and convenient for accessing mental health services was also revealed, along with recommendations to make the service user-friendly, affordable, available 24/7, and to ensure anonymity. A hospital call center service was developed to provide mental health information and advice in two languages through interactive voice response and live calls with healthcare professionals and peer support workers (recovering patients). Early implementation results indicate positive user feedback, with callers appreciating the inclusion of peer support workers who share their personal recovery journeys. However, some recommendations from participants (e.g., adding video calls options) could not be accommodated due to resource limitations or technical feasibility, and it is not possible to address individualized clinical questions such as prescriptions.

Conclusions: This study demonstrates a systematic and theory-driven approach for developing contextually appropriate digital solutions for improving mental healthcare in Uganda and similar contexts. The positive reception of the implemented service underscores its potential impact. Future research should address the identified limitations, and evaluate clinical outcomes of long-

term adoption.

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Abstract

Background: Mental health conditions are a significant public health problem globally, responsible for over 8 million deaths per year. They also lead to lost productivity, exacerbate physical illness, and are associated with stigma and human rights violations. Uganda, like many low- and middle-income countries (LMICs), faces a massive treatment gap for mental health conditions, and numerous sociocultural challenges exacerbate the burden of mental health conditions.

Objective: To describe the development and formative evaluation of a digital health intervention for improving access to mental healthcare in Uganda.

Methods: This qualitative study employed user-centered design and design science research principles. Stakeholders, including patients, caregivers, mental healthcare providers, and implementation experts (N=65), participated in focus group discussions in which we explored participants' experience of mental illness and mental healthcare, experience with digital interventions, and opinions about a proposed digital mental health service. Data was analyzed using the consolidated framework for implementation research to derive requirements for the digital solution, which was iteratively co-created with users and piloted.

Results: Several challenges were identified, including a severe shortage of mental health facilities, unmet mental health information needs, heavy burden of caregiving, financial challenges, stigma, and negative beliefs related to mental health. Participants' enthusiasm about digital solutions as feasible, acceptable and convenient for accessing mental health services was also revealed, along with recommendations to make the service user-friendly, affordable, available 24/7, and to ensure anonymity. A hospital call center service was developed to provide mental health information and advice in two languages through interactive voice response (IVR) and live calls with healthcare professionals and peer support workers (recovering patients). In the four months after go-live, 456 calls, from 236 unique numbers, were made to the system. Eighty calls stopped at the IVR, 99 went to voicemails (out-of-office hours), 231 calls were answered by call agents, and 22 were not answered. User feedback was positive, with callers appreciating the inclusion of peer support workers who share their recovery journeys. However, some participant recommendations (e.g., adding video call options) or individualized needs (e.g., prescriptions) could not be accommodated due to resource limitations or technical feasibility.

Conclusion: This study demonstrates a systematic and theory-driven approach to developing contextually appropriate digital solutions for improving mental healthcare in Uganda and similar contexts. The positive reception of the implemented service underscores its potential impact. Future research should address the identified limitations, and evaluate clinical outcomes of long-term adoption.

1. Introduction

Mental health conditions are an important public health issue globally, responsible for over 8 million deaths per year [1–5]. Three million people die annually from the harmful use of alcohol, and one person dies every 40 seconds by suicide [1,2]. An estimated 970.1 million people (12.6% of the global population) experience some form of mental health problem [4]. Mental health conditions account for 5% of the global disability-adjusted life years and 12-20% of years lived with disability [4,6]. People with mental health conditions, on average, die 20 years prematurely [4,6] both due to mental as well as physical illness, because mental health conditions are a risk factor for, or can complicate physical illnesses, including physical injury and road traffic accidents, HIV/AIDS, cardiovascular diseases, and cancer [5,7]. People with mental health conditions also experience severe human rights violations, stigma, discrimination, abuse, and generally poor socio-economic status [5,7–9].

Unfortunately, over 75% of people with mental health problems do not have access to the care they need [1–3]. This is especially true for Uganda[10,11] and similar low and middle-income countries (LMICs) where the treatment gap for mental disorders reaches 90% [12–14]. It is estimated that the ratio of mental health workers to population is 200 times smaller in LMICs compared to high-income countries [3]. In LMICs, mental health is under-prioritized in the face of other competing public health challenges such as HIV/AIDS, tuberculosis, malaria, and maternal and child health. Uganda, for example, spends 9.8% of its gross domestic product on healthcare, but under 1% of this goes towards mental healthcare [10,11.] Consequently, Uganda suffers from a shortage of mental health care facilities and professionals and poor and inconsistent access to medication and related mental health services [11.] In addition, most of the health workforce is limited to urban areas, yet over 80% of the population lives in rural areas, thus geographically isolated from even the limited care available. Other important challenges facing mental health in Uganda include social norms [15], beliefs (such as witchcraft), lack of awareness of mental health disorders [8,11,16], pervasive stigma, and socio-political conflicts [17,18]. These result in an increase in the incidence of mental health problems but also lead to many people with mental health problems not seeking care and going undiagnosed.

To address some of the challenges above and improve access to mental health services in Uganda, we implemented the project *digitalizing mental healthcare and access in Uganda (DiMHA)*. In this project, we followed a user-centered design and co-creation process to set up a hospital call center service to provide mental health information and advice to patients, caregivers, and the general public. The objective of this paper is to describe the development and formative evaluation of this mental health call center service.

2. Methods and Results

2.1. Study design

Ethical approval for the research study was obtained from Makerere University School of Public Health research ethics committee (#SPH-2021-153) and the Uganda National Council of Science and Technology (#HS1868ES). All participants provided written informed consent before participating in the study activities.

We conducted a qualitative case study employing principles of user-centered design (UCD) [19–22] and design science research [23,24]. UCD focuses on understanding and prioritizing the needs, preferences, and behavior of end users of a product throughout its development life cycle. UCD, therefore, calls for iterative and collaborative engagement of users to ensure high usability and utility of the product. Design science research (DSR) is a structured approach to creating and evaluating innovative solutions or artifacts, where the design process is treated as research that contributes to knowledge for improving the functional performance of artifacts. The steps involved in DSR mirror UCD, and

include the following: (i) identifying the problem and motivation (understanding user experiences and context of use), (ii) defining the objective of the solution (specifying the requirements), (iii) designing and development of (often novel) solutions using participatory or co-creation processes, and (iv) demonstration and evaluation to validate against requirements, assess usability, and long-term adoption. These steps help identify facilitators and barriers of adoption so that they can be addressed early on in the project life cycle, allow user engagement and facilitate buy-in, ensure that the product fits the context of use and purpose, and has good usability [25,26] and clinical utility [27].

In the following sections, we describe each of the above four steps. Note that there was overlap and iterations over the steps as per UCD best practice. To ease readability, we report the procedure and results from each step. Thereafter, we provide a general discussion and conclusion.

2.2. Step 1: understanding user experiences and context to identify the problem(s)

2.2.1. Participants and recruitment

The participants included adults (18 years or older), patients recovering from mental disorders, caregivers of such patients, peer support workers (PSW), mental healthcare providers, and persons involved in the implementation of call centers for telecoms or other healthcare centers. The healthcare providers, patients and caregivers, and PSWs were recruited from Butabika National Mental Referral Hospital in Kampala, Uganda, which is also the site of implementation. Sampling was purposive to include different cadres and expertise of providers (informed by the 3rd author, who is the head of Butabika Hospital) and to represent different mental health conditions, levels of education, and socio-economic status of patients and caregivers, so as to get diversity of experiences and views. The investigators (JKK, JN, and VMK) physically approached the healthcare providers at Butabika Hospital, explained the project's purpose and the research activities involved (including participation in multiple group discussions and workshops), and obtained consent from those interested. These healthcare providers then reached out to patients under their care, caregivers, and PSWs, provided them with information about the study, and invited those interested for consent by the investigators, who explained the participants' rights and voluntary nature of participation. Participants in the last stakeholder category were recruited through the network of the first author working in the digital health field in Uganda.

2.2.2. Data collection

We conducted semi-structured focus group discussions (FGDs) in which we explored participants' experience of mental illness and mental healthcare in Uganda (including unmet information and supportive care needs), experience with call center services from the commercial service sector or other digital healthcare services, and opinions about a proposed digital mental health service (i.e., feasibility, appropriateness, expected benefits or recommendations for successful implementation). The FGD guide is shown in Table 1. There was flexibility in the order of the probes to allow free flow of ideas, with additional probes for clarification added by moderators as issues of interest arose. Also, certain issues or probes were discussed in detail, paraphrased, or left out as appropriate depending on relevance to the session participant, or if such a topic had been sufficiently explored in the prior sessions.

Table 1: Focus group discussion guide.

Topic	Questions/Probes
Participants' understanding of mental health and mental problems	a) What is mental health, and what is mental health illness? b) Do you know any forms of mental illness? What are the signs and symptoms? c) What do you do with a person who has mental problems? What have you experienced? What is usually done, and what should be the correct thing to do? d) Where can one get treatment? **Probe** about alternative healers, witchcraft, religious healers, etc

	e) How are mental health or mental illnesses viewed in your community? **Probe** about stigma, myths, fear, and marginalization
Mental health information, psycho-education, and psychosocial support	f) What information about mental health problems or mental healthcare do you wish you knew early on in your mental illness journey? g) What issues or topics do you think are the most important to address now? Are there any topics or issues that you still need information about? Give examples. h) How/where do you get information about mental health and mental illnesses? Which ones are the best/preferred? i) Tell us any challenges or limitations of these information sources. j) Are there any services or persons that support you to cope with mental illness or care for your relatives with mental illness? Tell us more about these.
Tele-mental health services	k) Tell us about your experience with interactive voice response systems (IVR) or call centers: Which industry or business? Any challenges and advantages? *Note: Moderator to explain IVR if participants do not know and can use the examples of telecoms or bank customer care lines to explain* l) What are your thoughts on using such IVR systems for mental health information and care (tele-mental service)? **Probes**: any experience of tele-mental health services, anticipated benefits, limitations, considerations on how to make it work, concerns about timing, phone ownership and access, privacy, etc. Probe for details and examples. m) What are the likely barriers or facilitators for such a service? n) Any thoughts about staffing and the role of peer support workers? **Probe** about acceptability to patients, benefit to PSWs, any anticipated challenges and how to mitigate them. o) Any other thoughts about using technology in mental healthcare?

The sessions were conducted in English and Luganda (the lingua franca in Uganda) as appropriate for the participant category. Additionally, we held male-only and female-only FGD sessions for patients to reduce the possibility that some participants would overshadow others during the discussion, but other sessions were mixed to ensure rich discussions since diverse viewpoints from the different participants inspire others and spur discussion (see Table 2). The first and fourth authors (JKK and VMK) were the moderators, while the second author (RN) was a notetaker. The sessions were audio recorded and afterward transcribed by the second author, who also translated the Luganda ones into English for analysis. The FGDs took place in November 2021.

We drew on the consolidated framework for implementation research (CFIR) [28] to inform data collection (and analysis; see section 2.2.3 below). The CFIR is a "meta-theoretical framework" developed by consolidating several implementation science theories into one comprehensive taxonomy of clearly defined, non-overlapping constructs related to disseminating and implementing evidence-based interventions. These constructs fall into five domains: (i) the individuals affected or involved in the implementation, (ii) the innovation (intervention), (iii) the inner setting (organization) where the innovation is implemented, (iv) the outer setting (wider societal context), and (v) the process of implementation. The CFIR is one of the most widely used theoretical frameworks to identify implementation barriers and facilitators (i.e., a determinant framework) [29–33]. Following a literature review and feedback from researchers who have used the CFIR [31], a recent update, dubbed "CFIR 2.0", has been made, in addition to a CFIR outcomes addendum [34]. These updates have provided further clarification between constructs, including, for example, a distinction between "implementation determinants," which relate to the context, versus "innovation determinants," which have to do with the characteristics of the innovation (e.g., ease of use, relative advantage, cost, and efficacy of a technology). The implementation and innovation determinants inform the implementation process (needs assessment, user engagement, tailoring to user needs, incentives, marketing, etc), and through the antecedent assessments (tension or readiness for change, feasibility,

acceptability, appropriateness, etc) moderate the anticipated and actual implementation outcomes. The updates to the CFIR make it also useful for informing the design, implementation and evaluation of innovations (i.e. a process and evaluation framework) [32,33]. Figure 1 shows an adaptation of the CFIR and its recent updates as used in this study.

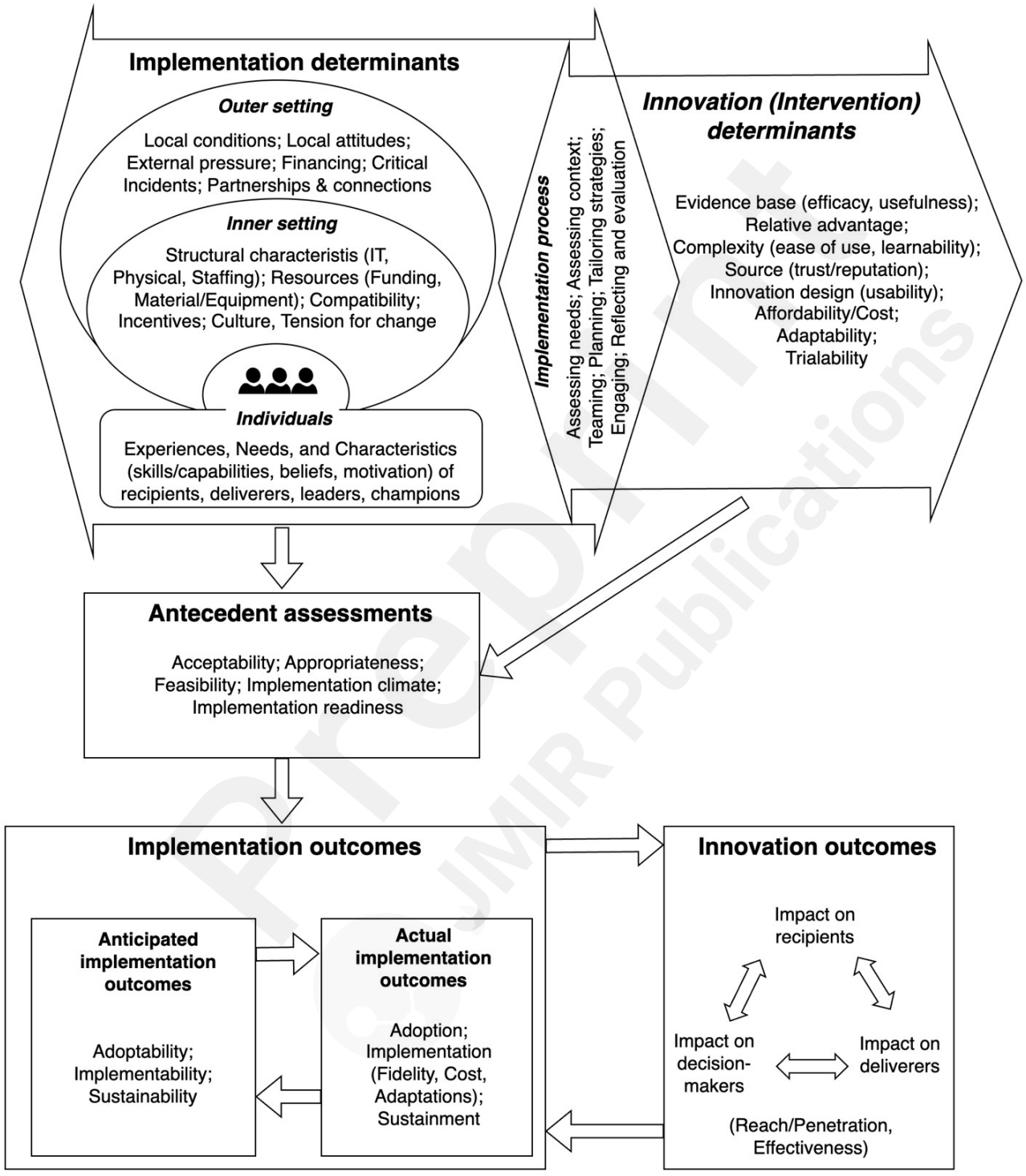

Figure 1: The consolidated framework for implementation research (CFIR) used in the study. Adapted from [28,31,34]

2.2.3. Data analysis

A directed (deductive) content analysis approach [35] was used. We began with a rapid qualitative

analysis [36–38] of the FGDs in order to quickly identify the requirements and other insights needed to inform initial iterations of system development (see Step 2 below). Rapid qualitative analysis is aimed at getting actionable and targeted insights in a timely manner and is suitable for studies such as this one, where there is a need to refine and adapt an intervention or program, as opposed to developing new theories. A deductive approach is taken, employing existing theories or frameworks (in our case, the CFIR) to summarize the qualitative data into, for example, intervention characteristics or barriers and facilitators. In rapid qualitative research, data collection and analysis occur concurrently and iteratively, with findings from one phase informing the next iteration. The analysis is done not on the transcripts but on summaries or notes taken during the FGDs or the audio recordings. In addition, multiple data collection methods are used to triangulate findings (e.g., FGDs, field observations, debriefing and reflections by the research team or other stakeholders, and literature review). In our study, the rapid analysis was done by the first 4 authors (JKK, RN, JN, and VMK) and involved note-taking during FGDs and discussion and summarization of insights after each session. When necessary, listening to recordings was done, e.g., for the researcher who was not present in the session before they contributed to the analysis, or for validating the summaries. We summarized the findings into an initial list of mental health information topics to be covered by our system and design considerations (system requirements) based on the experiences and expectations of users, as well as contextual constraints.

Later, a traditional qualitative analysis was done [36–38]. The first and second authors (JKK and RN) independently read one of the seven transcripts and extracted meaningful units or statements, and coded them into themes related to the research objectives and the CFIR as described above. They then met to discuss and refine the coding before independently coding the remaining transcripts. Three more meetings were held to compare and refine the coding, after which the findings were shared with all the authors for discussion and interpretation. We focused on saliency [39] rather than frequency of issues and codes, such that even if an issue was mentioned once or by one participant category, we coded it as long as it related to the research question and CFIR constructs. As such, we did not count or rank the codes and themes. Basic office software was used for coding and summarizing the qualitative data.

2.2.4. Results

2.2.4.1. Participants and FGD sessions

We conducted 7 FGDs, each with 8-10 participants, for a total of 65 participants. The participants were fairly balanced by sex (35 females and 30 males), and their ages ranged from 21 to 64 years, with a median of 40 years. Each session lasted approximately one and half hours. Table 2 shows the details of the FGD sessions.

Table 2: Details of focus group discussion sessions

FGD session #	Stakeholder category	n	Sex	Language	Notes
1	Patients	10	Female	Luganda	Sessions in Luganda (the most commonly spoken local language) and separated males and females to ensure participants speak freely and not overshadowed by opposite sex. Diagnoses represented included Bipolar affective disorder, Schizophrenia, and Psychosis
2	Patients	8	Male	Luganda	
3	Caregivers	9	Mixed	English	Separate sessions in English and in Luganda to get opinions from participants of different education status (English is learned in school in Uganda, and is proxy for education and socio-economic status). Diagnoses represented included
4	Caregivers	10	Mixed	Luganda	

					Bipolar affective disorder, Schizophrenia, and Psychosis, Epilepsy, Alcohol and substance abuse.
5	Healthcare providers	10	Mixed	English	Staff of Butabika hospital involved in care for patients and community outreaches, including psychiatrists, psychologists, psychiatric nurses, and psychiatric clinical officers.
6	Peer support workers (PSW)	10	Mixed	English	Volunteers with lived experience of mental illness. They work with Butabika hospital to share their personal experience, support and educate other patients. They receive small stipend from the hospital, patients they help, or from projects and grants to facilitate their work. Diagnoses represented included Bipolar affective disorder, Schizophrenia, and Psychosis.
7	Implementers	8	Mixed	English	Customer care for telecoms, developers of IVR systems, and implementers of hospital call centers in HIV/AIDS and cancer, private telemedicine company (general care), mental health NGO

2.2.4.2. Findings from the FGDs

Table 3 shows the qualitative findings, including the CFIR domains, constructs, themes, and their explanation. Appendix 1 contains the illustrative quotes.

Thirty-nine themes emerged across twenty CFIR constructs in all the five domains and the antecedent assessments. The themes recurred across the participant groups, supporting their validity (Appendix 1 shows quotes from different participants under each theme and domain). The themes under the *individuals domain* highlight several challenges that people with mental health conditions in Uganda face, including the limited number of mental healthcare facilities, long distances to care, lack of mental health information, stigma against patients with mental health problems and their families, financial challenges, and unmet psychosocial needs. The themes also cover contextual issues that explain these challenges. These include issues about the nature of mental illness (chronic and with a high burden of caregiving); organizational issues (*inner setting*), such as under-staffing of mental health facilities and frequent medication stockouts; and societal issues (*outer setting*), such as beliefs and cultural norms (e.g., belief in witchcraft) which influence how people understand mental health problems and how they seek care. Themes under the domain *innovation determinants* covered participants' perception or expected benefit from the proposed mental health call center service, including affordability, familiarity with similar services and the technology (ubiquitous access to mobile phones), convenience, time and cost saving, and anonymity offered by telephone services which protect users from the stigma. Finally, themes in the *implementation process* domain encompassed mostly participants' recommendations or strategies for successful implementation, such as linkage with other stakeholders involved in mental healthcare, marketing of the service (sensitization), training and supervision of staff for quality control, and the need to maintain the human touch rather than attempting to digitalize or automate mental healthcare delivery. These findings suggested the feasibility, acceptability, and appropriateness of the proposed solution (*antecedent assessments*).

There were also several insights or implicit findings not mentioned by the FGD participants but inferred from observations and the research team's understanding of the context. These are relevant for the implementation and can be mapped to CFIR constructs. For example, there has been an increase in the adoption of telemedicine in Uganda, especially following the COVID-19 outbreak, which has given credibility to such innovations and can explain the general enthusiasm shown by the participants (CFIR construct "evidence base" in *innovation determinants*). In fact, the participants in

the implementers' category were themselves involved in implementing call centers for HIV/AIDS, private telemedicine clinics, and mental health NGOs and were aware of the growing scientific evidence globally that supports digital health. COVID-19 is also an example of "critical incidents" that can disrupt (or encourage) implementation and/or delivery of innovations (*outer setting*), according to CFIR 2.0. Other issues included the external project grant (construct: "Financing"), Uganda government's positive digital transformation strategies and policies (construct: "External pressure"), and Butabika hospital's position as a national referral that is supposed to be exemplary (construct: "Performance measurement pressure").

Table 3: Summary of qualitative findings coded according to the consolidated framework for implementation research (CFIR).

CFIR Domain	CFIR Construct	Theme	Explanation
Individuals	Experiences of recipients	Challenges accessing mental health services	There are several challenges accessing mental healthcare services, particularly for those who live in rural areas. Mental healthcare facilities are few, limited to urban areas, and often very congested with frequent medicine stock-outs
		Burden of caregiving	Mental illnesses come with a huge burden of caregiving which falls on family members. This leads to burnout, worry, psychological distress, and related challenges for the caregivers.
		Stigma	Patients with mental illness and caregivers face a lot of stigma from community and healthcare setting
		Toxic and chronic treatment	Treatment for mental illness takes a long time and has a lot of side effects
		Role of faith and alternative medicine	Spirituality plays a key role in mental healthcare, with many patients seeking care from (or taken by their families and caregivers to) religious healers before and/or while going to mental healthcare centers. Alternative or spiritual healers can positively contribute to holistic patient care but can also interfere or delay proper health seeking.
	Needs of recipients	Unmet information needs	There is limited understanding of mental illnesses, their causes and management. Alternative explanations, especially from faith healers lead to confusion and affect health seeking and adherence to treatment.
		Unmet supportive care needs	Patients and caregivers have significant unmet psychological support needs due to the burden of caregiving and the nature of mental illness
	Personal attributes	Financial challenges	Patients and caregivers face financial hardships related to extant poverty, healthcare costs and loss of work
Innovation determinants	Affordability	Toll free access	To minimize financial barriers, access to the system should be free of charge to the users.
	Complexity	Familiarity with call centers	Call centers are ubiquitous, for example in the telecoms customer service centers, and so is access to (at least basic) phones. Target recipients are familiar with the technology and similar services.
	Relative advantage	24/7 access	Users consider or expect the system to be accessible round the clock which is very advantageous since patients may prefer (or need) to access the service during out of office hours (e.g. at night).
		Convenience, time and cost saving	Remote access to care is convenient and saves time and costs involved in traveling. Sometimes traveling to a health facility is not possible, in which care the call center would be the only avenue to get care.
		Efficiency	The call center system allows maximum utilization of the

		gains	few available mental healthcare workers
		Anonymity	Given the stigma associated with accessing mental healthcare services, a call center system is advantageous as it offers anonymity.
	Trust	Privacy and confidentiality	Users need assurance of confidentiality and privacy of their information in the call center system
		Reliability	There were concerns about network stability to allow continuous and reliable access
Inner setting	Structural characteristics	Staffing (Workforce)	Mental health care providers are few compared to the patients load; and patients' conditions are complex and require a lot of time. The professionals also have other obligations such as teaching. The call center should have sufficient personnel to handle the calls to avoid congestion and long call waiting times
		Medication stockouts	Inadequate supply of medicines and other supplies in mental health facilities
		Physical infrastructure	Limited physical space for patients to be comfortable when getting care
	Culture	Stigma (from healthcare setting)	Mental health is not discussed openly as is the case with other health care issues, and some healthcare providers stigmatize patients with mental illnesses
		Beliefs	Beliefs about the cause of mental illnesses, such as witchcraft or "curse of God", mean that users seek alternative care options as opposed to modern medicine, which can lead to under-utilization of the service
		Patient-centeredness	Call agents need to be compassionate and patient with the users of the system because they are suffering from mental illness which can affect how they communicate. They should be prepared for difficult callers.
Outer setting	Local attitudes	Beliefs	Beliefs about the cause of mental illnesses, such as witchcraft or curse of God, mean that users seek alternative care options as opposed to modern medicine, which can lead to under-utilization of the service
		Stigma and exclusion	Patients are stigmatized and excluded, they are not involved in decision making for their care, and sometimes families give up on them (do not take them for proper care or incarcerate them)
	Policies and laws	Consent for minors	Potential legal dilemma when it comes to minor who cannot consent but could access the service.
		Inertia towards telemedicine	Healthcare professionals are still hesitant towards remote care
Implementation process	Teaming	Linkage with other stakeholders	Work with other stakeholders and services providers such as the police, faith healers, and primary healthcare providers who are all involved in management of people with mental illnesses.
	Engaging	Marketing and sensitization	There is a need to market the service so that potential beneficiaries are proactively sensitized about its existence. Similar projects have used social media or bulk SMS.
	Planning	Contingences and escalation	Incidents or cases that cannot be managed on phone can happened and a contingence plan should be in place
		Training and supervision	Call agents need to be trained, supervised and supported to provide the service, especially the peer support workers who are not professionals but rather recovering patients.
		Scope of service	Limit scope to providing general information, triage and directions which is more achievable and serves majority of the recipients
	Tailoring	System design and features	Offer different features or options for channels of communication and languages to cater for different user profiles

		Human touch	Patients with mental illnesses and their caregivers need a human touch, so there should be a possibility for users of the service to interact with people. The technology should not replace but complement current services delivered by people.
	Reflecting and evaluating	Challenges with data collection	The anonymity and remote access could me that the data collected is unreliable as it is difficult to confirm it (e.g. the identity of callers). This also affects continuity of care
Antecedent assessments	Feasibility	Technological feasibility	Access to mobile phones is ubiquitous, so it is feasible for target recipients to access the service However, there were some concerns about network connection problems and lack of access to electricity for some users which would affect meaningful access and use of the service.
	Acceptability	Familiarity with call centers	Call centers are ubiquitous, for example in the telecoms customer service centers, and target recipients are familiar with them and can easily use them.
		Inertia towards telemedicine	Healthcare professionals are still hesitant towards remote care
	Appropriateness	Appropriateness of digital tools for mental healthcare	Non-pharmacological interventions such as psychotherapy and psychosocial interventions are an important part of mental health care and this can be delivered via remote communication platform. However, since some non-verbal communication is lost in remote services (especially voice-based), the service may be inappropriate in some cases where this is necessary e.g. for diagnosis or assessing affect. Some mental illnesses or states might also be incompatible with digital tools, e.g. hallucinations.

2.3. Step 2: Specifying the requirements of the system

2.3.1. Procedure and Team

Requirements were specified basing on the understanding of the users' needs, challenges, and contextual constraints from the FGDs. The development team consisted of the first three authors (a medical doctor and digital health expert, a research nurse, and a senior consultant psychiatrist, respectively), as well as a psychologist, a psychiatric nurse, and an IT professional specializing in telephone systems. The first two authors and the IT professional have previously worked together to set up a similar system at the Uganda Cancer Institute [40] from which they also drew insights. The team held eight online meetings from December 2021 to March 2022 to iteratively discuss the system features, content (mental health information), and set up considerations. We started with the initial list from the rapid qualitative analysis (see section 2.2.3 above) which we refined to remove conflicting requirements or those that are not feasible due to available resources (e.g., video telemedicine). We also agreed on the priority the features and mental health information topics.

2.3.2. Results

Table 3 lists the high-level requirements and how they were addressed in the system design and implementation. Key of these requirements are that the system or the intervention provides correct mental health information and psychosocial support, in a culturally sensitive and non-stigmatizing manner, and in multiple languages. In addition, the system should be easy to use (navigate), should be accessible 24/7, should be affordable (free) to users, there should be no long queues, and it should fit within the workflow of the staff and not increase their workload. Finally, it should ensure privacy and confidentiality to users' information and risks of harm to users should be minimized through quality control measures, training, and professionalism of staff.

Table 3: Requirements and how they are addressed by the system and/or its set up.

Requirements	Design and set up the system to address the requirements
The system or service should provide users with correct information about mental health problems – their causes, symptoms, how they are managed, where to get care from	The system consists of an interactive voice response system (IVR) with information on different topics such as overview of what mental illnesses are, the causes, signs and symptoms, the common mental illnesses in Uganda, assessment and management of mental illness, and how to navigate the healthcare system (See Figure 2). The call agents are also trained on this information in addition to their clinical expertise as nurses, psychiatric officers, and peer support workers
The system or service should provide users with psychosocial support	Call agents offer counseling and empathetic advice to callers. Peer support workers share personal experiences with mental illness
Information provision should be culture-sensitive and non-stigmatizing	Call agents understand the culture (including beliefs, norms, stigma around mental illnesses, and care-seeking for mental illness). They also have experience communicating with patients as clinical staff of Butabika National Mental hospital, or have personal experience as peer support workers (patients recovering from mental illnesses). Furthermore, refresher training was given at the start of the project, including a workshop by personnel from a customer service center for a telecom company, a hospital call center for HIV/AIDS support, and a private telemedicine service (described in Table 2). The training covered issues as empathy, respect, being non-judgmental, being calm, showing interest in the caller, and listening attentively.
Focus should be on triage and information should be generic advice rather than individualized clinical assessment (diagnosis) or medication prescription	Call agents trained and regularly given feedback on this
Staff (call agents) should act professionally, remain within the limits of their expertise and escalate complicated cases to more experienced colleagues or encourage clients to physically go to a healthcare facility	Call agents trained and regularly given feedback on this. One of the agents (a psychologist) and the third author (a consultant psychiatrist) are designated as contact persons for escalation. There is also an instant messaging group with all call agents and the project team to consult or report issues.
Service should be accessible 24/7 and callers should not wait long in the queues before being served	IVR allows automated access (self-service) of the mental health information and therefore available 24/7. Voicemail feature allows users to ask questions even during out-of-office hours or when staff are unavailable or busy. Multiple (twelve) session initiation protocol (SIP) trunks were procured to connect to the telecom service provider which minimizes chances of congestion for incoming calls, and allows for easy scalability if more trunks are needed A “ring all” strategy is used for live calls, i.e., for outbound calls, the system dials all available agents at the same time increasing the likelihood that the caller is responded to without waiting. All agents are encouraged to respond to the calls immediately, and a schedule exists for responding to voicemails.
The service should not increase the workload of hospital staff or interfere with their workflow	We created mobile extensions, i.e., routing live calls to mobile phones carried by the call agents as opposed to softphone extensions on the desktop, to allow flexibility for the staff to answer calls even when off site, in clinics or wards. They do not have to go to a designated call center room. The “ring all” strategy also allows call agents who are busy to safely ignore the call which is then answered by colleagues in the ring group who might not be busy at that moment. We used peer support workers (recovering patients) to supplement the limited healthcare workforce, and using IVR allows automation thus reducing the burden staff.
Information should be available in multiple languages	Information is available in English and Luganda, the most commonly spoken languages in Uganda.

	Other languages are planned in the future.
Information should be easy to understand and navigate	Information was carefully curated and the IVR organized in such a way to ensure ease of understanding and navigation. There is minimal use of medical jargon and description of concepts or illnesses are provided in addition to naming them. Information is presented in a logical order in the IVR i.e., from general information (overview of mental illnesses) to specific (e.g., individual illness such as anxiety or depression). The IVR tree manageable number of options (2 – 6 options), and navigation instructions are repeated at the end of each branch or in case the user enter an invalid option.
Various channels of communication should be used to ensure different users have access	The system is accessed via basic telephone calls (no internet required) making it accessible to anyone with a mobile phone. Access strategies include IVR, live calls and voicemail to serve different user preferences or ensure access during out-of-office hours or when there are high caller volumes. Other features such as SMS, USSD, online access and video calls which were mentioned could not be implemented in this phase of the project due to resource limitations but are planned for the future.
There should be no financial barriers to users when accessing the system (should be free or affordable)	System is reverse-billed, i.e., phone bills paid by the receiver (hospital) and therefore toll free to the callers
There should be mechanisms to ensure security, privacy and confidentiality of callers' information	Call agents and members of the implementation team received training in good clinical practice and human subject protection, and issues concerning information security, privacy and confidentiality are regularly discussed in the team meetings. Call agents have mobile phones dedicated to the call center service and do not use their personal phones. The phone numbers of the callers are hidden by the system when dialing the call agents, it instead displays the SIP lead number, and the agent must physically access the dedicated call center client computer on site at Butabika hospital to see caller details (e.g. when returning a voicemail). The client computer is password protected and kept in a locked room. The server on which the system run and where call recordings are stored is kept in different server room that is only accessible to IT staff.
There should be training and ongoing supervision to ensure smooth operation and minimize risk of harm to callers	Training workshops were held before system go-live, followed by mentorship and technical support for 6 months by the first author and IT consultant. All calls are recorded for the purpose of auditing the conversations and quality control. Regular (two weekly) team meeting are held in which any challenges are discussed, and random calls are reviewed to provide feedback and peer learning.

2.4. Step 3: Design and development of the system

2.4.1. Procedure and Team

We designed and developed a telephone system for providing mental health information and advice to callers as per the requirements (see Table 3). The system consists of three complimentary components or features; an interactive voice response (IVR), live calls, and voicemail. The IVR is the first component that users interact with, and since it is automated, it is available 24/7. It contains mental health information in audio format in English and Luganda. Callers get navigation instructions and choose from a menu of topics in a self-service manner by pressing the corresponding keys on their phones (e.g. *"Thank you for calling Butabika Hospital. Please choose your preferred language. For English, press 1, Bw'oba oyagala kuwuliriza mu Luganda, nyiga 2"*). Figure 2 shows the IVR flow and topics covered.

From the IVR, callers can choose to speak directly (live call) with an agent, for example to ask seek more clarification on information in the IVR or ask information that is not covered by the IVR. If it

is during office hours, the system connects the caller to the agent. We had a total of eight agents comprising of two PSWs, a psychologist, two psychiatric clinical officers, and three psychiatric nurses. The staff do not sit in a physical call center; rather, they are accessible via dedicated mobile phones. All their phones are dialed concurrently ("ring all" strategy) and whoever picks first responds to the caller. Outside working hours, callers are instructed by the system to leave a voicemail and the call agents returns the calls the next day; this is only possible from a soft-phone on a computer within the hospital since the caller's number is hidden on the agents' mobile phones for privacy reasons. All agents were encouraged to respond to the calls immediately, and a schedule was created for responding to voicemails. The psychologist provided supervision to the agents and handled any difficult cases which the agents were encourage to report or escalate whenever necessary.

Development of the system began by developing IVR content (mental health messages and navigation instructions), which was done concurrently with the requirements specification process described above. The team iteratively wrote the script for mental health messages basing on their clinical expertise, reviewed the Luganda translation, and discussed the IVR menu options and caller-system interaction basing on requirements and insights from prior work. We limited the IVR options to a manageable number and organized the information in a logical order, i.e., from general information (overview of mental illnesses) to specific (e.g., individual illness such as anxiety or depression). Attention was paid to ease of language (e.g., description of concepts or illnesses in addition to naming them, and reduction in use of medical jargon), tone (calm, empathic and non-judgmental), and cultural appropriateness (e.g., acknowledging the role of faith and alternative medicine). The developed content was recorded in a professional audio recording studio and deployed in private branch exchange (PBX) software by the IT professional and the first author.

2.4.2. Results

The telephone system was implemented using Asterisk, an open-source private branch exchange (PBX) software. It was deployed on a simple server (Intel Core i5 2.6GHz, 8GB RAM, 1TB Hard disk) at Butabika hospital, and connected to a local mobile telecom provider via session initiation protocol (SIP) with 12 trunks. The calls to the system are reverse-billed, therefore are free to the callers.

In sum, we developed a total of 22 messages, 14 of which are on mental health or other practical information needs elicited from the participants, i.e. overview of what mental illnesses are, the causes, signs and symptoms, the common mental illnesses in Uganda, assessment and management of mental illness, and how to navigate the healthcare system. The remaining 8 messages contained navigation instructions or feedback to user (welcome message, language selection, disclaimer and warning in case of emergency, the different menu options, invalid selection, replaying a message, returning to main menu, and voicemail instructions). The messages were then translated to Luganda for a total of 44 messages. Figure 2 shows the topics addressed by the IVR messages (without some of the navigation messages).

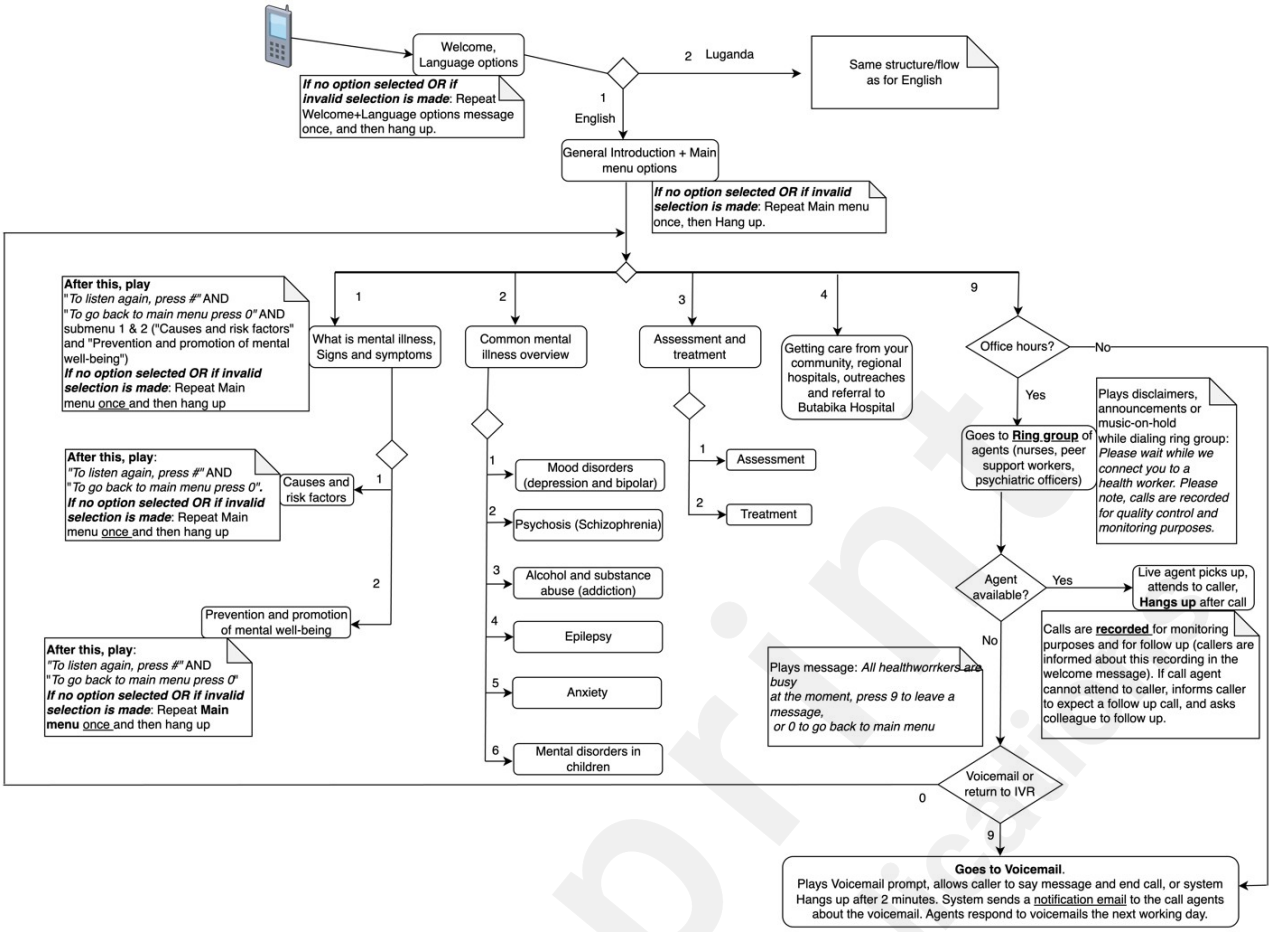

Figure 2: Mental health information topics and how they are accessed in the IVR.

2.5. Step 4: Demonstration and evaluation

2.5.1. Procedure and participants

Following deployment, we held a one-day workshop with the PSWs, nurses, and psychiatric clinical officers (n=10) who had participated in the FGDs to test the system, get feedback about the IVR content, and identify and correct any system malfunctions or errors (e.g., if there were language mix up or a wrong response for a particular IVR option chosen by the caller).

We held a second workshop to train the call agents on workflows, software system and on phone etiquettes and how to communicate with persons with mental health problems. We also discussed operational issues, e.g., definition of office hours when live calls should be allowed, and schedules for returning voicemails and evaluation survey.

The system was advertised via the hospital website and social media channels, posters in the hospital, and through personal contacts of the staff and participants. After go live, we continued to supervise the call agents, and held regular review meetings in which we listened to recorded calls and critiqued the conversations, and offered support to the call agents (especially the PSW) in case of difficult calls, and collected feedback on usability and user perception of utility of the service.

2.5.2. Results

No major problems were found during the testing workshops, but participants reported that the workshops helped them better understand the service from practically trying it out. They showed enthusiasm for their roles as call agents and became ambassadors who advertised the service to patients and their social networks. Schedules were also drawn for returning calls and office hours

defined which were then programmed into the PBX, sending calls outside these hours to voicemail. The system went live in August 2021. Detailed results from a survey of the callers and analysis of the usage patterns will be reported in a separate manuscript (under preparation), but here, we summarize observations from the first four months of operation.

From August to December 2022, 456 calls, from 236 unique numbers (average of 4 calls per day), were made to the system, i.e., reaching at least the IVR (automated) component. Of these, 99 (21.7%) calls were made during out-of-office hours for the call agents, so they went to voicemail and were called back within the following days. Of the remaining 357 calls made during office hours, 80 (22.4%) calls stopped at the IVR, while 231 (64.7%) proceeded to speak to a live agent. (Note that the percentages do not add up to 100% because some callers made multiple calls, utilizing the IVR or leaving a voicemail, and later called and spoke to a live agent). Twenty-two calls (6.2%) were never answered by the call agents. On average, live calls were answered within 11 seconds, and their average length was 3.5 minutes.

Callers come from all parts of the country (as far as 8 hours by road from Butabika Hospital), although the majority were from the central region (within one hour's distance from Butabika Hospital). They included caregivers seeking advice about relatives who are showing symptoms of mental illnesses or those already undergoing care, mental health patients who are relatively stable and are seeking advice about medication or return dates, and others such as clinicians from other health facilities, journalists and government officials who wanted more information about the call center system or the mental healthcare services offered at Butabika hospital. Calls about patients who had "escaped" from the hospital, were also common, often made by concerned community members near the hospital who come across a person with mental illness wondering in the community. Generally, the service has been received positively. Callers were especially happy with the PSW who shared their personal journeys with mental illnesses and recovery, and this encouraged them to overcome the stigma and negativity they had about mental healthcare services. The PSWs also reported positive experiences, stating that working as call agents and helping others gave them a sense of purpose and brought order and calmness.

A key challenge was callers who required specific and individualized information which the call agents did not have at hand and could not be pre-recorded in the IVR. Such information included requests for prescriptions, questions on stocks of certain medications, availability and cost of certain tests and procedures, or about the condition of a relative who is admitted in the hospital.

2.6. Reflexivity

The members of the research team involved in data collection and analysis (FGDs, workshops, and analysis meetings) are intimately familiar with the local context and understand participants' realities (including participants' access and use of mobile phones and the internet) since they come from the same region of the country and speak the local language (Luganda). This made it easier to communicate with the participants (even for sessions that were held in Luganda), and to understand and relate to the ideas or issues they raised. To reduce potential undue coercion, the clinicians involved in the care of the participants (patients and PSWs) did not participate in the FGDs sessions but participated in data analysis and interpretation. These clinicians were especially important in ensuring that the rest of the research team members were aware of assumptions and potential prejudices, for example, with regards to beliefs in witchcraft as a cause for mental illnesses or in faith-healing, common among those with low education status. Clinicians working in mental healthcare in this context frequently encounter such beliefs and appreciate the importance of respecting them, which was also useful for informing how we crafted the mental health messages in the system. Moreover, three of the research team members were from a different, high-income

country, and brought in different perspectives, which helped us question our interpretations and assumptions.

3. Discussion

3.1. Principal findings

This paper describes the development and implementation of a digital health intervention aimed at improving mental healthcare in Uganda. Employing principles of user-centered design [19–22] and design science research [23,24]., we systematically engaged stakeholders, collected data on target users' experiences of mental healthcare, their opinions and recommendations about the proposed mental health telephone service, and contextual issues that could influence implementation. We used the CFIR, an established implementation science meta-framework [28–33], to collection and analysis of this data, derive system requirements, and then iteratively co-created and tested the system.

We identified several challenges faced by patients with mental health problems and their caregivers in Uganda, and peculiarities about the organization and the wider societal context which supported the proposed innovation. These challenges included the severe shortage of mental health workers and services, lack of awareness, negative beliefs and norms, stigma, huge burden of caregiving, and financial challenges. At the same time, there is a general trend towards digitalization of healthcare to improve patient experience and efficiency of healthcare, and participants were enthusiastic about our proposed call center because they are familiar with the technology, considered it feasible, affordable, convenient and efficient way to get mental health services without being stigmatized. The participants also gave several recommendations on how to successfully implement the intervention, for example by making calls toll free, ensuring 24/7 availability, providing mental health information in multiple languages, using technologies or channels that are appropriate to the context (telephone calls and IVR), sufficient staffing to reducing call waiting times, sensitizing people about the service, and training and supervision of the call agents to ensure quality service. Early evaluation of the intervention shows that clients are very positive about the service, particularly with the use of PSWs (recovering patients) who share their lived experience with others.

3.2. Comparison to prior work

Prior research has demonstrated value of mHealth in addressing some of the healthcare challenges in Uganda and similar contexts elsewhere. Systematic reviews on mHealth in general [41–47] or on specific clinical domains such as HIV/AIDS [47–49] and palliative care [50] have highlighted improvement of healthcare coordination and communication between patients and healthcare providers, patient adherence to treatment and reduction of loss to follow up, patient engagement and self-care, facilitation of community-based care, and improving access to care for rural or geographically isolated populations. Advantages such as ubiquity of mobile technology, affordability and acceptability by patients and health workers, interactivity and personalization, and saving of time and cost of traveling to health facilities, have been cited. Examples of prior studies on mHealth in Uganda include use of IVR, SMS and phone calls to support management of HIV/AIDS [51,52] and tuberculosis [53], use of IVR to address barriers to fistula care in Uganda [54], SMS for stroke rehabilitation [55] and IVR for provision of cancer awareness and advice [40]. There is also a commercial digital health company that has operated different mHealth services in Uganda for about 10 years [56]. Unfortunately, the use of mHealth in mental health in Uganda and Africa in general is limited [8,57,58]. This is likely due to the general underfunding of mental healthcare services [10–14]. Available research on mHealth in mental health is mostly from developed countries [59–63], with many interventions utilizing the internet and smartphone apps, which might not be accessible or affordable in Uganda or other LMICs. Interventions that utilize basic phone features such as SMS, IVR, and voice calls are more appropriate in LMICs as they overcome infrastructural limitations. Such interventions are also relevant for low-income and migrant communities in developed countries since these populations

face low digital health literacy and language barriers [64–67].

In the previous project led by the first author for the provision of cancer information [40], similar findings in terms of challenges faced by patients, requirements and recommendations for the system, and generally positive reception after implementation were reported. The cancer awareness system mainly used the IVR feature with pre-recorded information, with the option to speak to a live agent added as an emergency due to COVID-19 outbreak. The agents were healthcare workers (nurses and doctors) who, due to travel restrictions, had been freed to handle phone calls. While callers appreciated this feature, it is otherwise untannable given the limited number of health workers. In the current project, PSWs helped to address the shortage of healthcare professionals. A large multinational research study from Uganda and elsewhere has demonstrated the positive benefits of using PSWs, both for their own recovery and for the healthcare system [68–70]. Our current project builds onto this prior work to innovatively and efficiently put this under-utilized resource to use through digital health.

3.3. Strengths and limitations of the study

A strength of this study is the strong theoretical underpinning. Implementation studies have been faulted in the past for not being theory-driven which undermines the adoption of digital technologies [32]. The UCD and DSR approach used informed a systematic co-creation process of intervention development with user participation, while the CFIR allowed comprehensive review of user, technological and contextual issues to inform system requirements. Even so, we could not consider all the requirements or recommendations by the participants when designing the system because of resource limitations or contradictions. For example, some participants recommended adding video calling features to the system to enhance interaction and assessment of affect. Other participants had concerns about continuity of care which indeed is difficult to achieve with the current call center system that lacks electronic medical records or mechanisms to ensure callers are directed to agents they have interacted with before. However, adding such features would make the system complex, expensive, and inaccessible to some such as those that mentioned inability to work with smartphones or have connectivity problems. Still, the insights from this comprehensive assessment can inform future, incremental iterations of the system during scale-up.

4. Conclusion

Participants were enthusiastic about the proposed call center because they were familiar with the technology, considered it feasible, affordable, convenient and efficient way to get mental health services without being stigmatized. The system provided mental health information and linkage to healthcare providers and peer support workers. The information in audio format made it accessible even to the illiterate users, and the automated IVR allowed 24/7 access while reducing the pressure on the healthcare workforce. Translation to English and Luganda, the two most spoken languages in Uganda, increased reach, as did the reverse-billing (no cost to the caller) and use of basic telephone calls as the channel of access since many Ugandans still do not have affordable and reliable internet access.

5. Recommendations.

In this study, people with mental illness, caregivers, and health care providers deemed a telephone-based mental health care service useful and necessary to increase access to mental health information and care and reduce stigma towards people with mental health problems. This positive view needs to be harnessed to scale up digitalization of mental health care including providing therapy and establishing it in other mental health care settings in line with the current Ugandan digitalization policy and the 3rd National Development Plan (NDP III). This method of mental health care may be

replicable and scalable in other LMICs with mental health care system and personnel challenges like Uganda. Further research is needed to evaluate long-term adoption, patterns of utilization, and impact on clinical outcomes.

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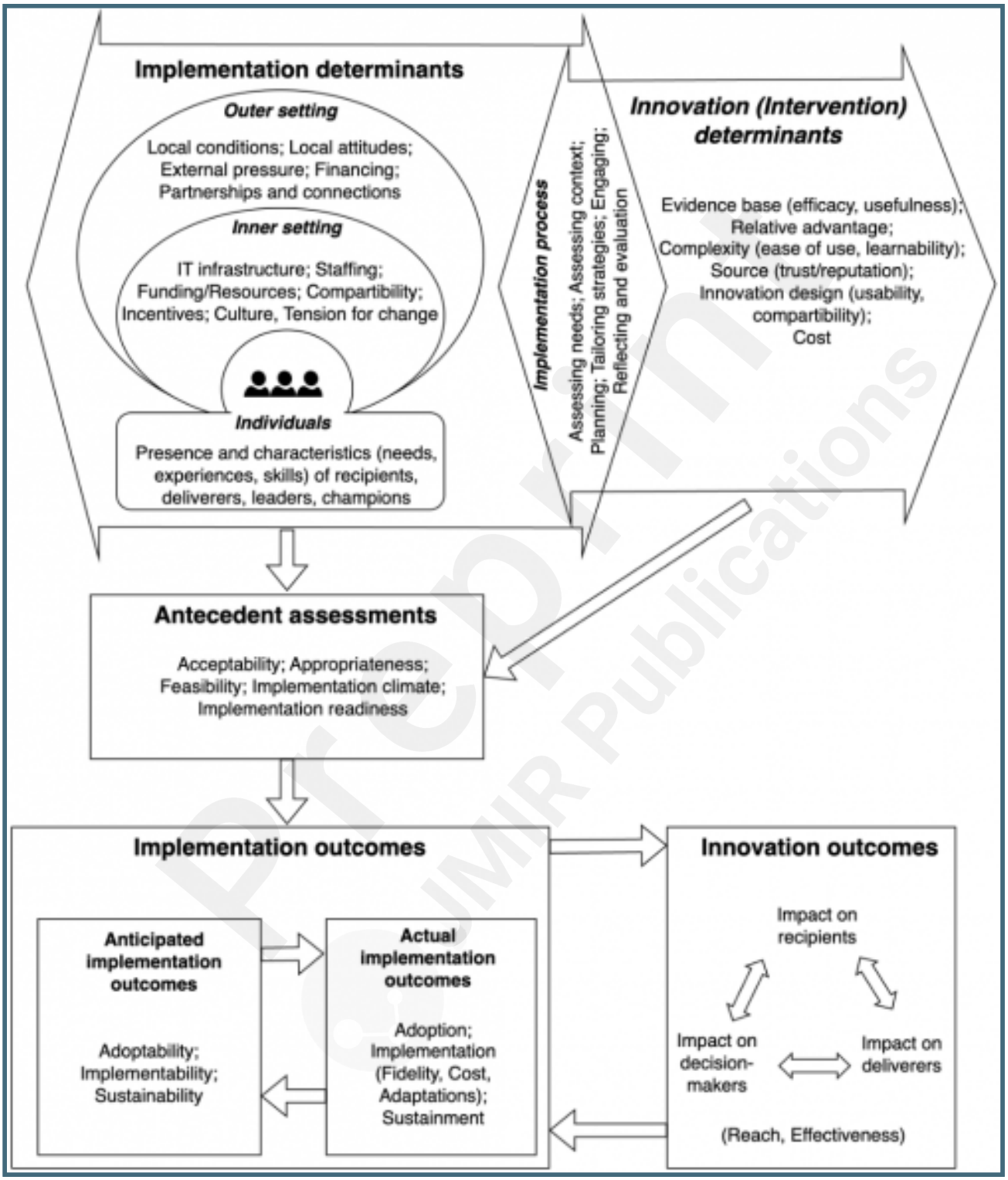
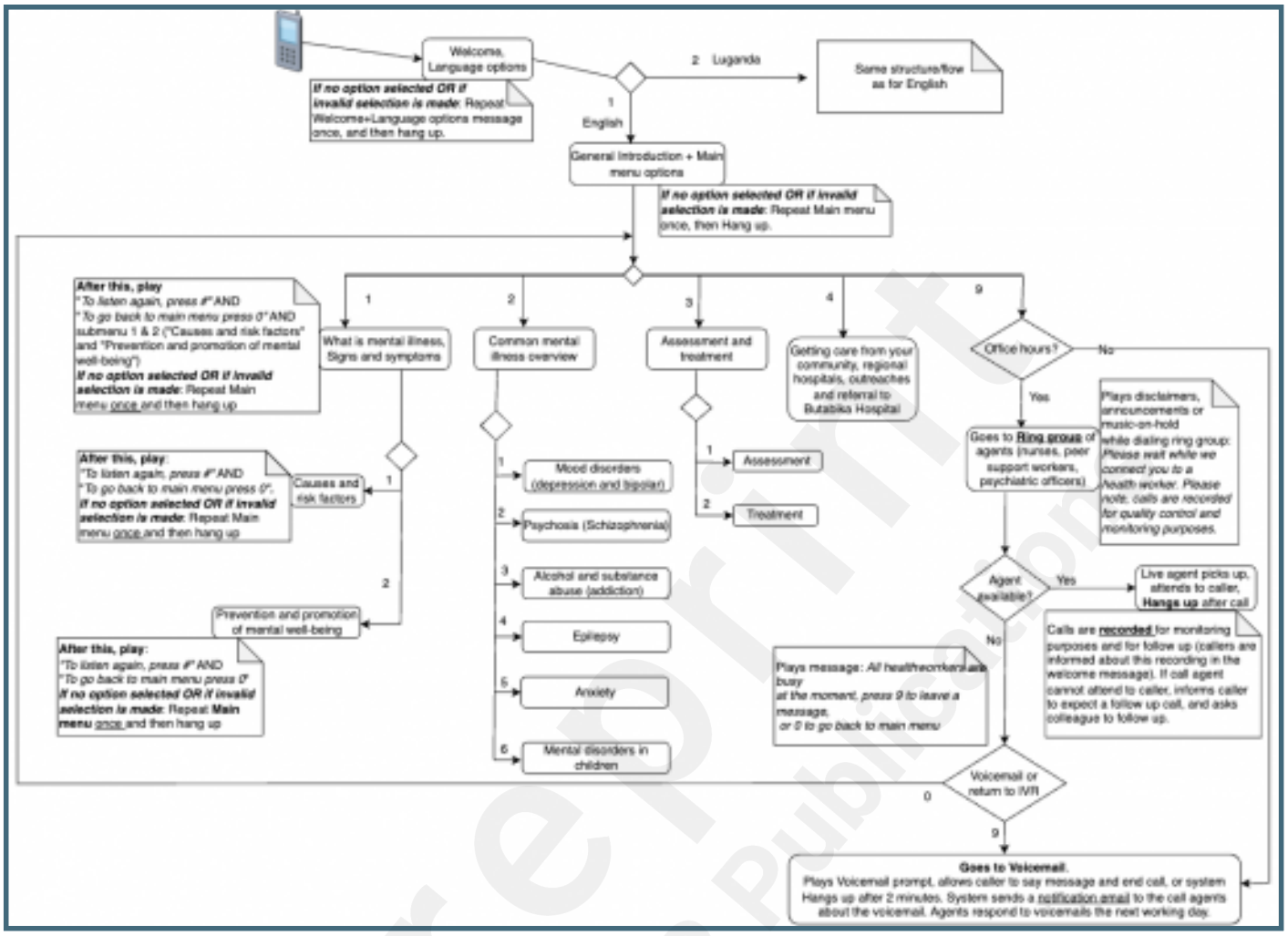
Supplementary Files

Figures

The consolidated framework for implementation research (CFIR) used in the study. Adapted from 28,31,34.



Mental health information topics and how they are accessed in the IVR.



Multimedia Appendixes

CFIR domains, constructs, themes from FGDs and Illustrative quotes.
URL: http://asset.jmir.pub/assets/2c5adc32d286a3c13ac5e6bf18a28678.xlsx