

**Designing a Voice-Based Treatment Module for Treating Perinatal Depression in Rural  
Kenya**

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## **Abstract**

Depression is the largest contributor to the worldwide disease burden of mental, neurological and substance use disorders. Addressing perinatal depression is a particular challenge in low- and middle-income countries where screening and treatment is not readily available. A potential solution to this treatment gap is shifting treatment from more skilled to less skilled providers. A treatment model using lay counselors in Pakistan demonstrated large reductions in depression rates but is challenging to implement at scale. This study investigated how mobile phones could be used to deliver treatment sessions remotely through an automated voice-based service, thus potentially easing the burden of implementing the program at scale in rural and remote regions. Working in Bungoma County, Kenya, we followed a Human Centered Design approach to adapting and testing a session of an efficacious treatment program developed in Pakistan called the Thinking Healthy Program. We conducted two rounds of testing with community health workers. Participants were randomly assigned to complete the session in person with a single facilitator or as part of a group, or remotely via a mobile phone with or without live operator support. Comprehension of session content was high and not significantly different across in person and phone conditions. Phone implementation was feasible and acceptable to participants, though refinement is needed. Results suggest that automated phone administration could be a viable method to deliver session content. Further testing should assess therapeutic benefits of such as system compared to standard, in person delivery.

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## 1. Introduction

Unipolar depressive disorders are the third largest contributor to the worldwide disease burden, and the largest of all mental, neurological and substance use (MNS) disorders. Even though these disorders are prevalent, treatment in Low and Middle Income Countries (LMIC) remains insufficient (*WHO Mental Health Gap Action Programme (mhGAP) Intervention Guide 2013; Brain Disorders: By the Numbers 2014*). Most individuals in LMIC cannot receive treatment because of a shortage of skilled clinicians, a dearth of primary care centers for treatment, lack of medication or prohibitively high costs and a lack of culturally sensitive-interventions, among other factors (Collins et al. 2011; Organization 2011). This treatment gap has been estimated at as high as 90 percent in LMIC (Organization and Noncommunicable Disease and Mental Health Cluster 2003).

Depression during pregnancy or in the postpartum period is of particular concern because of its high prevalence and the damaging consequences for both mother and child (Sawyer, Ayers, and Smith 2010). In a meta-analysis of studies on mothers in Africa, Sawyer et al. (2010) found a mean prevalence rate of depression of 11.3 percent during pregnancy and 18.3 percent after childbirth. Women who experience perinatal depression may receive less support from family members, experience worse physical health outcomes, have increased risk of substance abuse, and struggle to bond with newborns (Muzik and Borovoska 2010). Perinatal depression can lead to adverse health consequences for infants as well, such as increased risk for premature delivery or low-birth weight—which elevates the chances of fetal mortality (Matthews, MacDorman, and MacDorman 2013)—diminished mental, motor and emotional development compared to infants

of non-depressed mothers, elevated heart-rates, and worse performances on neonatal assessments, a measure of a newborn's abilities (Field, Diego, and Hernandez-Reif 2006).

Women in rural areas, especially those living in crowded households, are at highest risk of developing perinatal mental disorders in LMIC (Fisher et al. 2012). Rural areas, however, lack sufficient mental health clinicians to treat these women, because most clinicians are concentrated around larger cities in LMIC (Saxena et al. 2007). In the absence of skilled clinicians, a landmark study by Rahman et al. (2008) found that lay health workers could be trained to provide effective treatment for depressed mothers in a poor, remote region of Pakistan. Researchers developed this treatment, the Thinking Healthy Program (THP), based on principles of Cognitive Behavioral Therapy (CBT). CBT teaches clients to identify patterns of thinking that lead to negative feelings and behaviors and to replace these thoughts with more adaptive thoughts and behaviors. CBT is widely used in high-income countries as a way to treat several disorders, such as depression, anxiety, addictions, and has been found to be efficacious in many clinical trials (Butler et al. 2006). In the THP, researchers train lay health workers to provide depressed mothers with 16 CBT sessions over 12 months, centered around improving a mother's relationship with her newborn. Rahman et al. (2008) randomized depressed mothers in some areas to either receive the THP or general postpartum visits by lay health workers, to test the efficacy of the approach. Researchers reported a reduction in depression of over 50 percent in mothers who received the intervention versus mothers who received the standard care. Infants of mothers who participated in the THP were also more likely to be immunized and receive more play-time from their parents (Rahman et al. 2008).

These encouraging results contribute to a growing body of literature on the efficacy of psychosocial task-shifted interventions delivered by lay health workers (Tripathy et al. 2010;

Patel et al. 2010). To date, however, these interventions have proven challenging to deliver at scale. One obstacle to scaling is the availability of health workers. The THP relied on Pakistan's well-formed network of lay health workers—not all LMIC have such a system in place (Patel and Kirkwood 2008). Another challenge is providing consistent training. The “apprenticeship model” used in the THP, where lay workers receive regular supervision and follow-up training, can be difficult to scale because of high staff turnover and the need for a large research team to provide training (Murray et al. 2011). Studies of Tanzanian health workers found many were unmotivated to work because of poor supervision and inadequate training, and that poorly trained health workers led to lower-quality service-delivery (Manongi, Marchant, and Bygbjerg 2006; Olsen, Ndeki, and Ole 2005)

One possible solution to the challenges of scaling these task-shifted mental health interventions is to use mobile devices to screen for symptoms, monitor implementation, provide supervision, and deliver content to clients. This general approach is referred to as mobile health, or mHealth, and is being increasingly leveraged in the developing world to address disease burdens (Kahn, Yang, and Kahn 2010). Labrique et al. note that mHealth can be used to overcome constraints in health systems, like a lack of clinicians, and it can improve health systems in indicators like coverage, quality, equity and efficiency (Labrique et al. 2013). mHealth services can be used for a wide variety of applications, like collecting health data in the field, encouraging behavior change and education, and training health-care providers, among others. These applications often rely on basic mobile phone functions, such as short message service (SMS) and interactive voice response (IVR). IVR is well suited for poor, rural settings with high rates of illiteracy because users can listen to automated voice recordings and respond by pressing keys on the phone. IVR systems operate over voice lines and do not require

advanced phones or expensive data connections. IVR services have the potential to be widespread given the high rates of mobile phone penetration in rural areas. In 2013, 63 percent of rural households in sub-Saharan Africa had at least one mobile phone, and most individuals in the poorest 20 percent of the sub-Saharan population had at least one household mobile phone (Tortora 2014).

### **Research Question**

Despite the growing popularity of mHealth applications in low-income countries, there remain few examples of mHealth for mental health in LMIC. Given the high burden of disease associated with common mental illnesses and the lack of prevention and treatment options in many settings, particularly rural areas, it is important to develop and test potential mHealth solutions. A potentially promising first step is to investigate how mHealth can be used to bolster or enhance an in-person treatment model with demonstrated efficacy in low-income settings. The THP has been shown to reduce depression among postpartum women, but there remain barriers to wide-scale implementation. In this study, we adapted a THP session to be delivered via mobile phone and conducted two rounds of usability testing. We set out to determine the potential role of voice-based mobile phone technologies for treating perinatal depression in a rural, low-resource setting. We hypothesized that it would be feasible to adapt the in-person content for the automated mobile phone platform. We further hypothesized that users would find the mobile version acceptable and perform equally well on tests of comprehension.



## 2. Background

### Global Mental Health Burden and Perinatal Depression

Mental, neurological and substance use (MNS) disorders comprise 14 percent of the global disease burden, and are the largest cause of the disease burden in high-income countries (*WHO Mental Health Gap Action Programme (mhGAP) Intervention Guide* 2013; *Brain Disorders: By the Numbers* 2014). These diseases can account for up to a quarter of all Disability-Adjusted Life Years (DALYs), which are equated to a year of healthy life lost due to ill health (Prince et al. 2007). They also account for nine out of the 20 leading causes of years with disability worldwide. Mental health disorders are risk factors for a host of communicable and non-communicable diseases, and they increase the risk of infection for infectious diseases like HIV/AIDs (Noncommunicable Disease and Mental Health Cluster and Organization 2013).

This disease burden is significant around the world, but falls disproportionately on Low and Middle Income Countries (LMIC), which have higher incidence rates, lower per capita spending on mental health and a dearth of clinicians (Noncommunicable Disease and Mental Health Cluster and Organization 2013). In 2011, the World Health Organization (WHO) *Mental Health Atlas* report found LMICs required 1.18 million more mental health workers to provide adequate care. In 2011, Kakuma et al. noted that 50 percent of LMIC lacked an occupational therapist working in mental health. This disease burden also disproportionately affects women, who are estimated to have 1.5 to 2 times higher risk of developing mental disorders than males (Prince et al. 2007).

Despite the scale of mental disorders, investment in treatment and prevention lag far behind need for these services. Saraceno et al. identified five broad barriers to mental health treatments through a survey with international mental health experts and leaders. These barriers

include insufficient funding for mental health, concentrated pockets of coverage, poor integration in primary health services, too few trained clinicians and poor public policy by national mental health leaders (Saraceno et al. 2007). Many of these problems start at the international level—mental health was not included as a Millennium Development Goal (MDG) by the United Nations (UN), even though mental health can affect outcomes for diseases targeted by MDGs. These barriers are greatly augmented in LMIC, in part because these countries tend to prioritize infectious disease treatments over mental health care. A lack of clinicians compounds this problem. The WHO’s European Region has 200 times as many psychiatrists as all of Africa (Collins et al. 2011).

The Grand Challenges in Global Mental Health Initiative, a consortium of stakeholders and clinicians, list six major priorities to address mental health disorders. The initiative stresses that even small, incremental progress on addressing disorders could have significant economic benefits by increasing productivity and reducing inefficient health care allocations. However, funding still lags far behind necessary levels to achieve these priorities (Collins et al. 2011).

These challenges create an alarming treatment gap for those most in need of care. WHO estimates that 56.3 percent of people with depression do not receive appropriate care. This estimate increases to 67 percent in Africa and can be as high as 90 percent for LMIC (Kohn et al. 2004; Organization and Noncommunicable Disease and Mental Health Cluster 2003).

For women in LMIC, perinatal depression generally falls within this treatment gap. Perinatal depression is defined as “major and minor depressive episodes that occur either during pregnancy or within the first 12 months after delivery” (Gavin et al. 2005, 1071). There are four mental disorders grouped within perinatal depression: prenatal depression, the “baby blues,” postpartum depression and postpartum psychosis. Prenatal depression is depression that occurs

before a baby is born. The “baby blues” are mood swings that can occur for up to two weeks after birth. Postpartum depression are prolonged “baby blues,” which can last for up to a year after birth. A more severe condition is postpartum psychosis, which can include hallucinations and paranoia, and requires psychiatric hospitalization (*Understanding Maternal Depression, A Fact Sheet for Care Providers* 2005).

Perinatal depression is associated with a host of complications for mother and child, like infant under-nutrition, stunting, and lower quality interactions between mother and child (Gavin et al. 2005; Prince et al. 2007; Surkan et al. 2011). In a systematic review, Fisher et al. found common perinatal mental disorders (CPMDs), which most commonly include depression or anxiety, to be more prevalent in low and lower-middle-income countries than in high-income countries, despite fewer quality trials in the developing world (Fisher et al. 2012). In high-income countries, 10 percent of pregnant women and 13 percent of women who had given birth experienced a mental disorder. In low and lower-middle income countries these numbers increase to a weighted average of 15.6 percent before birth and 19.8 percent postnatally. In fact, the authors contend the prevalence may be understated because many studies recruited women from higher socioeconomic brackets, whom are less likely to experience CPMDs (Fisher et al. 2012).

Depression is also rarely screened for at the primary-care level, and mental health disorders in general are stigmatized in LMIC (Saxena et al. 2007). The combination of stigma and lack of screening exacerbate the treatment gap. As a result, women with depressive symptoms may not even seek treatment. Screening can also be ineffective because psychiatric disorders often go undetected during pregnancy, which can lead to antenatal depression or other behavioral disorders later in life (Muzik and Borovoska 2010; Kelly, Zatzick, and Anders 2001).

This problem is exacerbated in low-resource and remote areas in LMIC, which are even more unlikely to have access to mental health services at the primary care level. Women in these areas will bear the brunt of perinatal depression complications.

## **Treating Depression in LMIC**

The treatment gap and shortage of clinicians presents challenges in providing consistent, evidence-based care in LMIC. The WHO Mental Health Gap Action Programme (mhGAP) framework offers strategies to increase services for MNS disorders in LMIC. Recognizing the disorders so they can be treated by non-specialist health workers at primary and secondary care facilities (*WHO Mental Health Gap Action Programme (mhGAP) Intervention Guide 2013*). Non-specialist health workers can be effective at diagnosing and treating conditions in the absence of trained clinicians. Kakuma et al. note that lay health workers with brief training can identify and diagnose mental disorders, and provide treatment and monitoring for patients, reducing caregiver burden on other providers (Kakuma et al. 2011, 1). Such non-specialist health workers include Community Health Workers (CHWs), who are being used for treatment and diagnoses of mental disorders.

CHWs, as defined by WHO, are selected and held accountable by their communities, receive brief training and are part of the health system in some capacity (Lehmann and Sanders 2007). CHWs can help bridge the treatment gap in low-resource areas, because they need not undergo the same level of training as psychiatrists and psychologists. Using CHWs emphasizes task-shifting, which distributes responsibility for certain treatments from physicians to lesser-trained professionals. Task-shifting has been used to address health workforce shortages, notably for HIV/AIDS care, to bring a degree of care to low-resource settings (*Task-Shifting: Global Recommendations and Guidelines 2008*). There is consensus that addressing mental health

requires strengthening of primary care networks in LMIC (Prince et al. 2007; Saraceno et al. 2007). CHWs can strengthen primary care networks by substituting for physicians to provide treatment. Some studies, such as those by Alamo et al., suggest a task-shifting framework is a feasible alternative to address treatment gaps, but is labor intensive (Alamo et al. 2012). Multiple studies have concluded CHW interventions and trainings can decrease perinatal depression among mothers (Tripathy et al., Rahman et al., Patel et al.). A review concluded that using non-specialist health workers compared to normal healthcare services could increase the number of adults who recover from depression, as well as decrease symptoms for mothers with perinatal depression (van Ginneken et al. 2013).

Tripathy et al. (2010) achieved significant reductions in newborn mortality rates and reductions in moderate depression among mothers in a community intervention in Orissa and Jharkhand, two of eastern India's poorest states. Researchers trained community women, nominated by their peers, to facilitate lessons on proper hygiene and healthy behavior. In year three of the trial, moderate maternal depression scores on the Kessler anxiety and depression test decreased 57 percent compared to the control group (Tripathy et al. 2010). The MANAS study, a randomized controlled trial, used CHWs to lead mental health interventions (albeit not for perinatal depression) at public primary care facilities (Patel et al. 2010). Intervention group participants were more likely to recover from common mental diseases than the control group. The Rahman model in particular was a landmark study in using CHWs to address mental health challenges. Researchers used a Cognitive Behavioral Therapy (CBT) intervention led by CHWs to address perinatal depression in a low-resource setting in rural Pakistan (Rahman et al. 2008). CBT teaches clients to identify patterns of thinking that lead to negative feelings and behaviors and to replace these thoughts with more adaptive thoughts and behaviors. CHWs were trained on

a culturally relevant CBT session over two days, and then retrained three months into the intervention. CHWs visited mothers 16 times over the course of one year to carry out the intervention, known as the Thinking Healthy Program (THP). Each visit was around 45 minutes. Instead of a stand-alone intervention, the CBT sessions were integrated into the daily work and check-ups of the CHWs. Depression rates dropped by nearly half compared to the control group, a remarkable achievement for a brief program (Rahman et al. 2008).

These studies demonstrate the success of CHWs in treating depression under a task-shifting framework. However, barriers exist to scaling these treatments. Research indicates post-training supervision is crucial to ensuring successful clinical interventions, as well as continuous supervision (Murray et al. 2011). Initial training of health workers also required experts from the research team; scaling these treatments would require additional research team members and local supervisors, which could be challenging with high staff turnover. These interventions are also expensive and difficult to facilitate. The Rahman study was preceded by years of ethnographic study to determine a culturally appropriate psychosocial intervention. WHO notes CHWs must be carefully trained and selected, embedded in the community and extensively supported with material resources and political will, among other factors (Lehmann and Sanders 2007). Task-shifting requires intensive financial and political investments to be feasible in the long-run (Lehmann et al. 2009). CHWs are also often unpaid or poorly compensated, which can undermine their efficacy (Lehmann and Sanders 2007). These constraints highlight CHW treatments, while effective, can be impractical to scale for large populations if LMIC do not develop sufficient infrastructure. Without the ability to scale, CHW interventions will only reach a small fraction of women afflicted by perinatal depression.

## Mobile Health

Mobile phones, however, can offer a way to deliver health services in low-resource areas, and potentially scale treatments while controlling costs. mHealth is applying wireless communication devices towards health purposes, and is being increasingly leveraged in the developing world to address disease burdens (Kahn, Yang, and Kahn 2010, 254). Mechael notes phones offer advantages for health systems in LMIC, like being able to effectively work with both literate and illiterate populations (Mechael 2009). Phones are also widely accessible in LMIC, with mobile phone penetration estimated at 89 percent by the International Telecommunications Union (*The World in 2013: ICT Facts and Figures 2013*). Even among the poorest residents, mobile phone penetration is significant; Kenya's mobile phone penetration among its poorest residents is estimated at 60 percent and may even be much higher (Crandall et al. 2012).

Mobile phones have wide applicability in health interventions. Labrique et al. identify 12 common mHealth applications as a toolkit to overcome health system constraints. These applications, which range from electronic health record-keeping to data collection, highlight the diversity of applications mHealth can encompass. Uses for mHealth can also be grouped into applications for treatment compliance, data collection and disease surveillance, health information systems, health promotion and emergency medical responses (Mechael et al. 2010).

Case studies confirm the wide applicability of mHealth treatments. Puccio et al., for instance, used phone calls to remind patients to take medicine for an intensive antiretroviral (ARV) drug regimen for HIV treatment. The study found reduced viral load for most participants, who reported the calls helped them adhere to the regimen (Puccio et al. 2006). Mukund Bahadur et al. conducted a literature review of mHealth SMS services for HIV

interventions in South Africa. Researchers found, through 28 studies, that SMS services could be used to improve service delivery of HIV treatments by monitoring the progress of interventions (Mukund Bahadur and Murray 2010).

However, providing any effective mHealth service at scale will be challenging. There is still a lack of rigorous trials in low-resource settings within LMIC about the efficacy of mHealth treatments (Tomlinson et al. 2013). Systematic reviews, which include evidence from the developed world, find benefits from mHealth but indicate the need for more rigorous trials (Free et al. 2010; Free et al. 2013). In LMIC, many interventions fail to succeed past the pilot stage, or are too small to measure significant health impacts. Tomlinson et al. note that evidence-based guidelines, better implementation strategies and efficacy trials in LMIC are necessary, among other factors, to scale up mHealth services (Tomlinson et al. 2013).

### **mHealth for mental health**

A variety of applications have leveraged mHealth for mental health services, though the majority of studies present evidence from high-income countries. mHealth can be used to encourage and remind users to complete therapy assignments, monitor a patient's mood, provide updated health information, and be used for life-style interventions to reduce alcohol or smoking rates (Harrison et al. 2011). Harrison et al. further note mobile phones are particularly suited for mental health purposes because they are the preferred communication channel between young people, whom are most affected by mental health disorders and least likely to seek treatment (Harrison et al. 2011).

The advent of mHealth for mental health in high-income countries has been driven by smartphones (Price et al. 2013). The use of smartphone applications offers a way to engage patients with their treatments (Price et al. 2013). MEMO, a mHealth program developed in



Australia, used CBT and messaging to decrease depression rates among their sample. The myCompass system is a self-management tool delivered using phone internet browsers, to help users deal with moderate stress, anxiety and depression (Harrison et al. 2011). A United States-based program, Companion SMS, is designed for users with mild to moderate depression. It sends text messages to groups to monitor emotional health, and relays that information to clinicians who can respond. The program encourages patients to seek assistance through the convenience of mobile phones (Kwan 2013).

For low-resource settings in LMICs, there are much fewer trials examining the efficacy of mHealth for mental health. Current trials indicate some success in treating common MNS disorders, including depression within these settings. Kwan reviewed how mHealth depression treatments could be used in LMIC, and highlighted several case-studies of mHealth integration into health systems (Kwan 2013). The MINDS Foundation in India is using mobile phones to collect data from CHWs to monitor the mental health of patients. The Schizophrenia Research Foundation in India also used a telemedicine phone network to connect psychiatrists to rural patients, who often did not have physical centers nearby.

Interactive Voice Response (IVR) is a mobile phone function that can be used to deliver common mHealth applications. IVR systems rely on a central computer that offers information and questions to callers, essentially simulating a call with another person. IVR systems are classified under the mHealth framework as appropriate for client education/behavior change communication and electronic decision support (Labrique et al. 2013). Because they only rely on voice lines, IVR is most appropriate for illiterate populations. Several studies underscore IVR's versatility. Sadagopan et al. (2011) examined the development of an IVR system to disseminate information through the Lwazi Project. The project created a community telephone number for

residents to call, leave messages or receive government information. The authors conclude that automated telephone services could be effective at disseminating critical information (Sadagopan et al. 2011). Kim et al. studied the possibility of an IVR screening tool for perinatal depression in low-resource urban settings in the United States. 90 percent of subjects demonstrated willingness to complete an IVR survey as part of regular pregnancy care, and researchers concluded it would be feasible to use an IVR system to screen for depression among low-income, urban pregnant women (Kim, Bracha, and Tipnis 2007).

IVR systems have also been used to treat depression. Osgood-Hynes et al. (1998) examined how IVR treatments could deliver content for mild and moderate depression in the US and UK. Participants received introductory videos and booklets to guide them through a 12-week, 11 phone-call intervention, known as the COPE system (Osgood-Hynes et al. 1998). A computer algorithm tailored calls and advice depending on how patients responded to certain questions. Participants' mean Hamilton Rating Scale for Depression (HAM-D) scores, a measure of depression, improved significantly by the end of the intervention. Mundt et al. (2012) also demonstrated that depression could be screened for using vocal biomarkers over the phone. Participants read sentences, which were later analyzed by an algorithm. Speech pattern changes were matched with previously recorded depression scores, indicating that vocal markers recorded via IVR could be feasible indicators of depression severity (Mundt et al. 2012).

### **Current Study: Bungoma County, Kenya**

Like many LMIC, Kenya lacks sufficient infrastructure and resources for robust mental health services. Estimates vary, but Kenya reportedly has between 25 and 75 psychiatrists in the entire *country* (Jenkins et al. 2010). Mental health spending is reported as 0.5 percent of the health budget, of which 80 percent is spent on psychiatric hospitals (Gibson 2013). As a result,

most spending focuses on treatment of severe disorders instead of prevention, with little focus on common mental disorders like depression. Despite reforms, Kenya lacks a specific mental health policy using current evidence-based practice. The last comprehensive legislation was the 1989 Mental Health Act, which largely focused on hospital administration and in-patient procedures. Since then, mental health has been included in the 2004-2009 health sector reforms plans and other policy action plans, although these reforms do not address primary care treatment and have yet to be implemented (Jenkins et al. 2010; Ngugi 2011). More recent efforts include the draft 2014 Mental Health Bill (also cited as the 2013 Mental Health Bill), which takes more proactive efforts to address mental health care, especially at the community level (Gibson 2013). The bill mandates a right to mental health care, protection from discrimination, and includes language mandating improved conditions at mental health care facilities (*The Mental Health Bill 2014*).

Kenya's health system is grouped into six decentralized levels, with level six being the top-rung (general and referral hospitals), and level one being the lowest rung (families and households at the community level) (Jenkins et al. 2010). Despite this system, mental health care remains highly centralized because clinicians are concentrated in cities, presenting challenges for individuals who live far from psychiatric facilities. 70 percent of inpatient beds for psychiatric disorders are concentrated in Nairobi, as are most psychiatrist and psychologists (Ngugi 2011). There are four national referral hospitals which provide specialized psychiatric care, but which lack sufficient hospital beds to deal with their caseload. Large psychiatric facilities are also portrayed negatively. In May 2013, 40 inpatients escaped the level six Mathari Hospital after overpowering guards, and a 2011 CNN documentary critical of Mathari launched a national human rights inquiry (*BBC 2013*). Access to essential drugs for mental illnesses remains low.

Clinical centers have criticized the Kenya Medical Supplies Agency for delivering drugs for MNS erratically, leading to shortages at hospitals (Ngugi 2011).

The lack of primary care coverage and treatment contributes to the mental health treatment gap for those furthest away from cities. While coverage is better in private hospitals, these are expensive and thus largely inaccessible to low-income, rural individuals. Community-based coverage and prevention remains low overall (Gibson 2013).

This study took place in Bungoma County, Kenya to take advantage of existing work to develop a mobile phone screening and referral service for pregnant woman and new mothers called *Baby Monitor*. Bungoma County is a typical rural area in Kenya. Only 21.7 percent of residents live in urban areas, and most care is provided at 'dispensaries', level two primary care clinics that provide basic medical care. There are 76 registered public health facilities across the county to serve a population of 1.37 million people (*Kenya Open Data Survey 2014: Bungoma County Data Sheet* 2014). The Bungoma District Hospital, located in Bungoma Town, is the largest health center in the county.

### **3. Methods**

We adopt a Human-Centered Design (HCD) approach to study how to adapt an established face-to-face intervention to be delivered via an automated mobile phone service. HCD is a framework developed by the design firm IDEO to understand the needs and behaviors of target populations for health interventions. HCD actively incorporates stakeholders into the design and testing of interventions, and consists of three phases: 'hear', 'create', and 'deliver' (*Human Centered Design Toolkit* 2009). The 'hear' phase employs qualitative research methods, like group interviewing or experiential learning activities, to instill a deep understanding of a particular topic or community. The 'create' phase takes insights and research from the 'hear' stage and translates them into strategies and solutions. This involves synthesizing research, brainstorming ideas, creating prototypes and using feedback to create more refined products. The 'deliver' phase plans for implementation by creating models and plans to perfect the product and measure its impact. Braun et al. note this HCD approach, especially for health intervention design involving mobile phones, is still the exception than the norm (Braun et al. 2013).

#### **Hear Phase**

To apply the HCD framework, we first sought to understand the mental health needs of Bungoma County through a background literature review and background conversations with eight health care providers, including CHWs, psychiatric nurses, psychologists and psychiatrists. Conversations focused on the state and perception of mental health care in the county, mental health training, and current strategies for identifying and treating mothers who exhibit signs of depression. We also asked CHWs during usability testing how they treated women who exhibited signs of perinatal depression.

## **Create Phase**

Results of the 'hear' phase discussions informed the design of a prototype of a mobile phone version of a sample Thinking Healthy Program (THP) session. THP sessions generally begin by reviewing the previous session, and then teaching new content through pictures. Sessions conclude by assigning homework for the next session. The THP script is interactive and engaging, and the lay worker is integral to the approach. She asks comprehension questions centered on culturally relevant pictures and helps mothers fill out charts used to monitor their diet and mood. The lay health worker also inquires about a mother's feelings, a vital part of the CBT approach.

We adapted THP sessions for automated delivery via IVR. The phone prototype was created using Verboice, a free and open-source web application that allows people without computer programming skills to create IVR applications through a visual web interface. We created a call flow in Verboice that specified every branch that a call could take depending on the participants' responses (see Appendix A). For instance, the user might listen to an automated prompt that asks her to press 1 for 'yes' or 3 for 'no'. The next automated prompt could differ depending on the user's input, which is transmitted over the voice line. IVR systems like Verboice "listen" to tones to determine the key pressed; data connections are not required to transmit data. All automated prompts were recorded in English and Swahili by a native Swahili speaker and uploaded to Verboice.

We purchased a Skype manager phone number and connected it to our Verboice account so that users could call our system. Since incoming calls are free for mobile phone users in Kenya, we set the call flow to hang up on callers and initiate an immediate call back, thus billing

our account. Participants used our phone to trigger a free call back that would let them access the session.

### ***Round 1***

We created our Round 1 prototype from the second session in the THP, which explains how certain strategies apply to a mother's own personal health. We copied excerpts from the session explaining these strategies. These excerpts are explained through pictures, which guide listeners through a narrative about a mother. The last step of the session is to practice healthy thinking, and is incorporated through a homework activity of filling out a mood chart and an activity log. The activity log marks whether mothers had taken deep breaths or exercised for the day. In a packet provided to each participant, we inserted the pictures from the THP script, and inserted the mood and activity charts. This packet was explicitly referenced in our phone prototype. A face-to-face version of our prototype was created in a group format. Content-wise, each script was the same and used the same language from the THP. However, the group script included more open-ended questions and comprehension questions during the actual session. We included a 'record' step in the phone prototype for users to record a question, to mimic the open-ended questions of the group script. For instance, "Would you like to share some of the negative thoughts you've had? Please record your thoughts here" was included. The phone session used prompts like "Press 1 to continue" or "Press 3 to repeat this section" so that users could interact with the system.

### ***Round 2***

For the second round of usability testing we designed a new script based on concepts from the THP, but we deviated from the original structure. We also truncated the session to around 10 minutes instead of the 15-minute session in Round 1. In this round, we created a

depressed-mother character named Beatrice to guide participants through strategies in the THP. We supplemented the audio script with two comic strips (see Appendix B) that we commissioned. The script describes how Beatrice feels upset after her baby is born, and how she can feel better through different strategies (see Appendix C). The session asks participants if they have felt like Beatrice before, and includes comprehension questions to test what participants have learned.

We delivered this script in four ways: a face-to-face group session; a face-to-face individual session; an individual phone session; an individual phone session with live operator support. The content and comprehension questions were exactly the same for all scripts, though the Verboice session included phone-exclusive prompts like “Press 1 to continue”. One research assistant taught all the face-to-face tests and recorded her voice for the Verboice sections.

## **Deliver Phase**

In the last phase we conducted two rounds of usability testing of the prototype with CHWs pretending to be the new mothers they serve in their outreach. To be eligible to participate, CHWs had to speak English and work in 1 of 3 Community Units involved in the design and testing of the larger *Baby Monitor* initiative described earlier. The objectives of the testing were to assess the feasibility of delivering session content via IVR, to establish acceptability among users, and to test users' comprehension of session material.

### ***Round 1***

We recruited 12 CHWs to participate in testing sessions over three days. Our research assistant divided participants into two groups: either face-to-face group sessions or individual sessions delivered via mobile phone. Participants in the group condition met at the local



dispensary and received a briefing on the purpose of the test and were given some background on the THP by a Kenyan research assistant. The assistant then distributed a packet of illustrations taken from the THP guide to be used during the session. The assistant facilitated the session according to a script designed to mirror the mobile phone version to be tested. At the conclusion of the session, CHWs were instructed to complete a short homework assignment at home and return the following day. When they returned, the assistant administered a quiz to participants and conducted a brief feedback session about their experiences (Appendix E). The quiz assessed the THP steps, the learning objective of the session and the meaning of the illustrations.

Participants in the phone condition also met at the local dispensary, but not all of them were briefed on the purpose of test and/or the THP. Each participant received an illustration packet and were told to dial our prototype phone number on their mobile phone. We told them to keep their phone in speaker mode so we could monitor their progress through the call flow. At the conclusion of the session, CHWs were instructed to complete a homework assignment and then return the next day to be quizzed on the session. We also requested qualitative feedback on the illustrations and the design of the prototype.

## ***Round 2***

In the second round of testing, we recruited 20 additional CHWs (all women) and randomly assigned them to 1 of 4 conditions: (i) face-to-face individual session; (ii) face-to-face group session; (iii) phone individual session; (iv) phone individual session with 'live operator' support. CHWs were sorted into blocks of high- and low- education (less than 1 year of secondary school completed), defined as level of school completed, and randomized within blocks to each group (1:1:1:1 allocation). Groups were scheduled for separate days. In

preparation for these sessions, we provided our Kenyan research assistants with a detailed instruction sheet and conducted several practice sessions.

When CHWs arrived for their session, a research assistant used a script to individually introduce the purpose of the session and provide background on the THP. A second research assistant, also Kenyan, was present to take notes and make observations. The facilitator stressed that CHWs should pretend to be depressed mothers during the introduction. As a check on comprehension of the introduction, CHWs were asked to repeat the purpose of the session back to the research assistant.

In the face-to-face sessions, the facilitator followed a script that was nearly identical to the phone version of the session. In the phone sessions, participants initiated the call by dialing our number, which 'flashes' the system (i.e., calls and hangs up). CHWs in the 'live operator' condition received separate calls before and after the session to provide additional instructions and debrief; this condition was intended to mimic how the service might operate if women talked to a live provider before and after the automated session. At the conclusion of the sessions, the assistants administered a quiz individually to each CHW and then conducted a feedback session. The assistants were instructed to not assist participants during the phone tests.

## 4. Results

### Hear Phase

Discussions with healthcare providers and CHWs revealed important themes about how maternal depression is viewed and treated in the community (see Appendix D for more detailed excerpts). These themes included:

***Role of stigma.*** Stigma prevents patients from visiting hospitals and seeking out treatment.

CHWs noted confidentiality was extremely important so that mothers could open up about their conditions.

***Informal recognition and treatment of mental illnesses by lay health workers.*** CHWs receive no formal training to address *mental* health issues. However, they try to counsel mothers through empathy and listening, which is part of the approach recommended by WHO. CHWs can likely identify more serious cases of mental disorders because symptoms are more obvious.

***Shortage of health workers at all levels.*** There are not enough health workers to provide adequate mental health care. CHWs are not paid and must support themselves through other means, so they cannot meet with patients full time. In the absence of other clinicians, psychiatric nurses diagnose mental disorders and prescribe medication.

***Ineffective referral system.*** Patients are likely to fall through the cracks and not receive follow-up care because no one is tracking if referrals are actually completed.

***Pharmacological treatment used instead of, rather than in addition to, psychosocial therapy.***

Because of a shortage of clinicians, there is not enough time to carry out brief, structured psychosocial treatment with patients. Instead, drugs are prescribed but they may be out of stock or prohibitively expensive.

***Perception that mental health is not prioritized by health providers.*** Mental health is not prioritized because other illnesses present more tangible symptoms and may be more immediately life-threatening.

***Role of religion in treating depression.*** Many health workers during Round 2 of our usability study said they would tell women to pray or refer them to a religious source, such as the Bible or church leaders, if they exhibited depression symptoms.

Based on interview themes and the literature, we determined that an IVR system could have two major roles. One potential role is to screen for depression, track referrals, and monitor responses to treatment. Another potential role would be to deliver treatment content and provide 'booster' or review sessions. Any system should conform with certain themes identified during interviews. The system must be trusted so that respondents can answer questions truthfully, just as CHWs noted that their profession was based on confidentiality and trust. This confidentiality is crucial in mitigating stigma from discussing mental disorders.

## **Create Phase**

The interviews helped inform the development of a Round 1 prototype. The Round 2 prototype was influenced by the results and lessons from the first prototype.

## **Deliver Phase**

### ***Round 1***

A total of 12 CHWs participated in Round 1 testing (75% female), 5 in the face-to-face condition and 7 in the phone condition. We were unable to assess comprehension among all the participants in the phone condition because of technical challenges. We originally had two groups of 4 CHVs to complete the phone session—the first group was more familiar with the

THP, while another group had not been briefed on the THP. One CHW in the first group dropped out of the tests. We discovered mistakes in the call-flow that caused the calls to fail or to be routed to a different step. The IVR system itself also stopped functioning properly and began dropping calls due to an unrelated server error. As a result of technical errors, the 7 CHWs slated to take the phone test were sent home and returned on a later date.

We set out to measure session comprehension among the face-to-face and phone groups, but we did not administer the test to participants in the phone condition because of these technical challenges; instead, we debriefed with these participants to get a more qualitative understanding of their impressions of the system. Among the face-to-face group, comprehension was low. 4 out of 5 CHWs could not identify the learning objective of the session, and 5 out of 5 could not recall the steps of the THP without additional prompting. During the debriefing session, we learned that the illustrations taken from the THP guide were perceived to be not culturally relevant and confusing. It is not clear how much poor photocopying quality impacted this assessment.

To address the design challenge of referring illiterate women to specific illustrations during an automated call, we inserted clip-art images of familiar objects and made reference to these objects during the session. For instance, "Now look at the second picture, the one with the cat under it." We thought these familiar clip art objects might be more appropriate than numbers or letters, especially if potential users were illiterate. However, the pictures became a source of confusion. Instead of using the animals as reference points, all CHWs consistently included them in their explanations of what the pictures represented. One CHW, for instance, noted that these animals could be used for income-generating activities for mothers.

During the successful phone administration, participants appeared to complete the call-flow as quickly as possible, without paying attention to the content. Even though we did not administer a formal assessment, we asked participants about information in the session, and most could not correctly answer any questions because they had not paid attention. We also realized that the second group of CHWs might have been confused about the session objectives since they did not receive an introduction to the THP. CHWs also cited call length as a reason why the session was hard to understand. Most took between 12 to 15 minutes to complete the packet, and only one person used the “back” functionality of Verboice to review a previous step or concept. The length of the phone session seemed too long without any pauses, breaks or integrated comprehension questions.

## ***Round 2***

We used the results of the first round to redesign the prototype, illustrations, and training instructions for the facilitators. The second round was completed successfully. Comprehension was high across the administration conditions as assessed by post-session quizzes; the mean percentage correct among the in-person conditions was 88.6 percent (SD=11.3%), compared to 94.3 percent among the phone conditions (SD=7.4%). This difference is not statistically significant;  $t(15.5)=-1.3$ ,  $p=0.2$ .

Our research assistants conducted feedback sessions after the quizzes and recorded observations during the sessions. The individual face-to-face group was reported as being composed and attentive, and could largely answer all feedback questions administered during the session correctly. All reported they enjoyed learning about the session and hearing the story. To improve the session, most CHWs said the pictures should be numbered. In the group face-to-face

session, every CHW reported enjoying the session or finding it interesting, while a few also noted that numbering the pictures would improve the session.

The individual phone session reported more difficulties than the face-to-face sessions, despite demonstrating high comprehension of the session material. Most participants were unaware that the system would hang up on them after they called, before calling them back. The call they received also came from a private number, which added to the confusion. A majority of CHWs (8 of 10) even thought they were going to speak to someone “live” over the phone, instead of automated recordings, so they were taken by surprise. The prototype also has a bit of lag time between responses, so at times it seems like the system is broken. Two CHWs reported that this led them to find the system ‘extremely frustrating’, though others did not. Most CHWs found the content of the session easy to understand and follow, and some CHWs dialogued with the system by responding to the recordings and laughing during the prompts. Consensus existed that the audio quality of the recordings was low, however, and should be made better for future iterations.

The phone session with live operator support was initially hampered by two technical problems, so CHWs had to return three times to finally conduct a test. Many of the comments echoed the experience of the participants in the phone condition that did not include a live operator before and after the session. Some participants said that using an operator made the IVR session easier to understand, but others believed they were going to speak to another live operator instead of an automated recording.

## 5. Discussion

In this study we followed a Human Centered Design (HCD) approach to adapt a session in the Thinking Healthy Program (THP) for depressed mothers from an in-person administration format to a format suitable for automated administration via interactive voice response (IVR). We took an iterative approach to design and testing and made substantial revisions between the first and second prototypes.

On the basis of our design and testing results, we conclude that it is feasible to adapt in-person sessions from the THP for an IVR format. Comprehension of session content was equivalent among face-to-face and phone groups, even with poor network reception, suggesting that an IVR session could potentially work as well as a face-to-face format as a teaching tool. This study did not assess whether a phone format would have the same therapeutic benefits as an in-person format.

In large part, participants found the phone format to be acceptable, but follow-up discussions suggested several ideas for further refinement. Most participants did not know what would happen when they dialed the Verboice number, leading to confusion when the system called them back. Most participants also initially confused the automated system for a live person. Some phone condition participants reported being ‘very frustrated’ during their test because of lag times in our prototype, affecting their acceptability of the system. Every participant received a thorough introduction before their session, which described the THP, the purpose of our tests, and provided instruction to pretend to be pregnant mothers. However, phone participants received no further instruction, and our introduction did not explain how the prototype worked, that it was automated, or that in some instances they should expect delays



between prompts. A more thorough introduction for phone participants including these details should be incorporated into future prototypes.

Our study adds to a growing literature on the importance of design and usability testing of mHealth tools. Lerer et al. evaluated the IVR user interface of a CHW data collection system in Uganda, and found significant differences in task success rates between different designs (Lerer, Ward, and Amarasinghe 2010). Our tests similarly demonstrate how different designs can impact comprehension and satisfaction with our system. Our finding that automated phone administration does not reduce participants' ability to understand lessons is important because, in low-resource settings, human-resource shortages may prevent psychosocial interventions from being implemented at scale. While Rahman et al. 2008 found face-to-face interventions led by lay health workers can reduce symptoms of depression in low-resource settings, this strategy remains challenging to expand (Rahman et al. 2008). Our findings indicate that low-cost mobile phones, which are highly prevalent in low-resource settings, may be just as good at teaching coping skills as in-person counselors.

IVR for distance-learning is a relatively new application. Previous studies of IVR in low-resource settings have focused on patient adherence to drug regimens (Sidney et al. 2012; Haberer et al. 2010). In Senegal, Intrahealth International used IVR to provide a brief refresher course on family planning services to health workers, and found modest, but sustained, evidence of learning, even ten months after the course concluded (Puckett 2014). Our study provides similar evidence for the efficacy of IVR as a teaching tool, although further research is needed to test a full set of learning objectives associated with a full treatment protocol.

Our aim with this study was to establish proof of concept regarding the adaptation of an in-person treatment program for perinatal depression for automated delivery via mobile phones.

While the test was broadly successful, there are several limitations to consider. First, we recruited lay health workers and asked them to imagine themselves as patients. These workers tend to be more educated than the average patient, which could have resulted in better performance. Future tests with more advanced prototypes should involve actual patients. Second, we only tested one brief session. It is possible that some patients would not find the entire program to be acceptable if administered via mobile phone. Third, we did not assess therapeutic benefits. Thus, our finding that lesson comprehension was equivalent for in-person and automated administration does not imply that the automated version would produce the same therapeutic benefit. This is an important question that needs to be tested with a fully functioning prototype.

### ***Conclusion***

Our results suggest that automated services delivered via low-cost mobile phones deserve further development and testing to augment human-resource intensive approaches. Comprehension of a mock session was equivalent among face-to-face and phone groups, and acceptability of the system was high among phone participants. Refinements, like a more thorough introduction for phone participants, can improve future prototypes. Our findings demonstrate that an IVR system may be just as effective at teaching coping skills as face-to-face sessions. This is important because health worker shortages may prevent the administration of successful programs for treating perinatal depression, like the THP. Utilizing an IVR system may allow these interventions to be administered in areas without strong networks of health workers. Further studies are required to test participant comprehension and acceptability of longer sessions, as well as sessions which incorporate more elements of a THP session.

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# 7. Appendices

## Appendix A: Verboice Call-Flow Diagram

Below is the web interface of Verboice, which we used to program our prototype. This call-flow was used in Round 2 of our usability test. The steps in the call correspond to what the user will hear next:

October 2014 Usability Tests

Overview | **Call Flows** | Resources | Schedules | Phone Book | External Services | Feeds | Settings

10/5 Beatrice Stories  
Use the following tool to define the application's call flow

Export Call flow | include audio recordings

Import a new Call Flow:

Create new sub flow



The screenshot shows a complex call flow diagram with various nodes and connections. The nodes include 'Call back', 'id1', 'Link', 'id 2b', 'id 3', 'id 4', 'id 5', 'id 6', '6 back', 'id 7', '7 back', 'id 8', 'reason', and 'id'. The connections are represented by arrows and lines. A 'Save' button is visible in the top right corner.




The screenshot shows a simplified call flow diagram with nodes 'Call back', 'id1', 'Link', 'id 2b', 'id 3', 'id 4', and 'id 5'. The connections are represented by arrows and lines. An 'Add step' panel is open on the right, showing options: Play, Menu, Input, Forward Call, Link, Branches, Hang Up, Record, Detect Language, Mark as failed, Mark as successful, Call back, Send SMS, and Impersonate.



## Appendix B: Round 2 Pictures in Comic Book Format

We commissioned the following images for our second round of usability testing

	
<p><b>This is Beatrice and her newborn baby. Everyone was very happy for Beatrice when the baby was born.</b></p>	<p><b>Beatrice wants to feel happy too, but instead she feels sad and sometimes wishes she never had the baby.</b></p>

		
<p><b>First Step: Identify Negative Thoughts</b></p> <p>Beatrice is imagining not having her baby and feeling much better</p>	<p><b>Second Step: Replace Unhealthy Thoughts with Healthy ones</b></p> <p>Beatrice identifies her unhealthy thought and decides to think differently.</p>	<p><b>Last Step: Practice Healthy Thinking and Behavior</b></p> <p>Beatrice develops a stronger bond by singing to her baby everyday, and now feels closer to her child.</p>

## Appendix C: Script from Round 2 testing

The following script was used for the individual, face-to-face condition in Round 2 of usability testing. RA denotes Research Assistant. CHV denotes Community Health Volunteer. The script for mobile phone conditions was similar, but used a character named “Asiya” to narrate the section and included phone-specific prompts (like “Press 1 to continue”) at various points.

**RA:** Hi, my name is Sarah and I am a Community Health Volunteer. In this lesson, I will tell you a story about a woman named Beatrice who became very sad soon after her baby was born.

**RA:** Maybe you have felt like Beatrice, or maybe you know another woman like Beatrice. I'll tell you how Beatrice started to feel better so you can help yourself and others.

**RA:** Please look at the pictures on Page 1

***Wait until the CHV has seen the photos. Make sure the CHV is looking at the correct page, and help her find the right picture if she has not found it.***

**RA:** This is Beatrice and her newborn baby. Everyone was very happy for Beatrice when the baby was born.

**RA:** Beatrice wants to feel happy too, but instead she feels sad and sometimes has bad thoughts about the baby. Sometimes Beatrice wishes she never had the baby, and this makes her feel guilty and ashamed.

**RA:** When it is time to get the baby immunized, Beatrice thinks that there is nothing she can do to help or protect the baby, so she did not take the baby to the clinic.

**RA:** Do you ever feel like Beatrice?

***If the CHV says yes:***

**RA:** I know this must be hard for you. Becoming a new mother is stressful, so do not feel ashamed. Many women feel like you sometimes. The good news is that there are things you can do to feel better.

***If the CHV says no:***

**RA:** Maybe you know someone like Beatrice. Becoming a new mother is stressful, so tell her not to feel ashamed. Many women feel like this sometimes. Tell her the good news is that there are things she can do to feel better.

**RA:** I would like to tell you about a few ways to start feeling better. Please turn the page on your packets.

**RA:** Please look at the first picture on page 2.

***Wait until the CHV has seen the picture/pictures. Make sure the CHV is looking at the correct page, and help her find the right picture if she has not found it.***

**RA:** The first step to feeling better is to identify negative thoughts like the ones Beatrice has. Doctors believe that our thoughts lead to our behaviors. If our thoughts are unhealthy, our behaviors will be unhealthy. For instance, if Beatrice thinks that she cannot protect her baby from illness, she will not get the baby immunized.

**RA:** Do you understand everything so far?

***If the CHV understands everything correctly, then continue below. If not, then go back to review the section she did not understand. Read from this script when reviewing the section.***

**RA:** Let us do a quick review. What was one of the Beatrice's unhealthy thoughts?

**RA:** Do you think it is that Beatrice sometimes wishes she never had the baby?  
Or do you think it is that Beatrice sometimes thinks the baby cries so much because she is a bad mother?

***Wait until the mother responds. Do not wait more than 1 minute for a response.***

**RA:** That is correct! Both answers are examples of negative thoughts. In this picture, Beatrice thinks she will be much happier without her baby.

**RA:** To start feeling better, Beatrice needs to recognize that these are unhealthy thoughts. Have you understood everything so far?

***If the CHV understands everything correctly, then continue below. If not, then go back to review the section she did not understand. Or you can review the comprehension question. Read from this script when reviewing the section.***

**RA:** Now let us look at the next picture on page 2.

***Wait until the CHV has seen the picture/pictures. Make sure the CHV is looking at the correct page, and help her find the right picture if she has not found it.***

**RA:** The next step is to replace these thoughts with healthy ones. For instance, when Beatrice wishes she never had the baby, this makes her feel guilty and ashamed. This adds to her stress, which is bad for her and the baby. When Beatrice has this thought, she can identify it and decide to think differently. Beatrice can tell herself that it is OK not to have a positive feeling when the baby is born and that she can work on feeling more positive over time.

**RA:** I will say that again. Beatrice's unhealthy thought is that she does not want the baby. Beatrice can replace this thought by telling herself that it is OK not to have a positive feeling when the baby is born and that she can work on feeling more positive over time.

**RA:** Do you understand this?

***If the CHV understands everything correctly, then continue below. If not, then go back to review the section she did not understand. Or you can review the comprehension question. Read from this script when reviewing the section.***

**RA:** Another one of Beatrice's negative thoughts is that she cannot do anything to protect her baby. She can replace this thought and tell herself that her baby's health will be good if she gives it the best care possible.

**RA:** So let's review. What is the first step?

- A. Do you think the first step is to "identify unhealthy thoughts"?  
Or, B) do you think the first step is to "try to forget you are sad"?

***Wait until the mother responds. Do not wait more than 1 minute for a response. If the mother does not respond, assume she picked B.***

*If A),*

**RA:** That's Correct!

*If B),*

**RA:** The first step to feeling better is to identify negative thoughts. The second step is to replace these thoughts with healthy ones. These steps can be hard, but Beatrice can get help from her family and friends.

**RA:** Have you understood?

***If the CHV understands everything correctly, then continue below. If not, then go back to review the section she did not understand. Or you can review the comprehension question. Read from this script when reviewing the section.***

**RA:** Now please let us look at the last picture on page 2.

***Wait until the CHV has seen the photos. Make sure the CHV is looking at the correct page, and help her find the right pictures if she has not found them.***

**RA:** The last step is to practice healthy thinking and behavior. A good way to start bonding with your baby is to talk or sing to it every day. So if Beatrice identifies that she feels like she does not want the baby, she could start to sing the baby songs.

**RA:** This will help her to feel closer to her baby. As she feels closer to the baby, she will take better care of the baby, and the baby will be happier and healthier.

**RA:** We are now done with this session. Thank you for participating! We will now be giving you a short quiz and asking you a few questions about how you felt today during the sessions.

## **Appendix D: Mental Health Landscape of Bungoma County**

To understand the mental health needs of Bungoma County, Ishan Thakore conducted semi-structured qualitative interviews with health-care providers in Bungoma County, as well as in Eldoret, Kenya. The researcher had conversations with as many clinicians as possible about mental health services available in the county. The following interviews were conducted: two interviews with psychiatric nurses, one focus-group with 4 CHWs, one interview with a psychiatric nurse, one interview with a psychologist, one interview with a psychiatrist, and informal conversations with clinicians throughout Bungoma County clinics. Research assistants also asked health workers during Round 2 of usability testing about how they treated women with depressive symptoms.

Several themes emerged from these interviews:

### *Role of Stigma*

A clinical psychologist noted that stigma prevents patients from coming to hospitals before their symptoms are severe and require extensive treatment. This stigma extends to government policies. Publicly recognizing a disorder, according to the doctor, would mean breaking through the stigma and garnering broad public support. The public, according to him, still stigmatizes disorders and doesn't view them as large priorities. "If you have a mental illness you're a minority; no one cares about you" he said. This may be cultural or people may be uninformed, he said. If a woman is referred from a CHW to a higher-level clinician, she may not want to see a district level nurse because of the associated stigma of telling her family or friends.

CHWs noted that their patients encountered stigma. CHWs said they would try to dispel stigma as just "negative beliefs from [the] family" during counseling sessions, but it still persists.

CHWs also referred to confidentiality as especially important in developing a trusting relationship with patients. They noted confidentiality helps patients get over the shyness when discussing certain taboo topics like depression and sex. Trust, one described, was built through one's reputation.

#### *Informal recognition and treatment of mental illnesses by health workers*

As the first line of primary care, CHWs receive no formal training to deal and address mental illnesses. Their basic training consisted of one 14-day session run by an NGO, with only a small session on mental health. When addressing the baby-blues and depression, CHWs described their methodology of counseling and advice. They would give examples and use stories because they are "life-experienced," and advise mothers that children are "gifts from god." Stories, they said, helped women open up. They also said they counsel both women and men. A CHW said if you continue to advise women, they will accept it. "You make them feel happy," another said. If that doesn't work, a referral is issued.

The CHW approach incorporates part of WHO's recommended brief, structured psychological treatment (namely, taking time to listen to patients). They said that during a counseling session they would be empathetic and observant, and wait for mothers to express themselves. When asked how they developed this counseling and advice therapy, it seems to be more instinctual than something they were trained on, similar to how they may console a friend. A lack of training on a particular mental health strategy does not necessarily mean CHWs cannot make an impact. The Rahman study in Pakistan found that even CHWs without mental health training could still help decrease depression rates among mothers.

CHWs revealed they could distinguish between different mental illnesses, like depression and more serious cases, which might involve more extreme behavior like "ripping out hair."

CHWs seem to have an intuitive grasp of mental health illnesses, and they said they could identify the baby-blues by talking to women. Some said they could spot mental illnesses through observation. If some mental illness signs are not visible, CHWs might have a hard time recognizing certain illnesses are present.

*Extreme shortage of health workers at all levels*

All interviewees stressed there were not enough health workers to provide adequate mental health care. The CHWs described how their workload depended on whether it was planting season or not, with the former making it much more difficult to ensure people kept appointments. The CHWs described how they tried to create a few mothers' groups to build a community so people could have regular access to care. But in the absence of formal training and mothers' groups everywhere, patients were not regularly visited by CHWs.

A psychologist noted there is much better money in other medical fields, so there are no incentives for professionals to become clinical psychologists, or for medical students to take psychology courses. He noted that in 2013, only 1 in 100 medical students in his hospital applied for a further specialization in psychiatry. He said there were only six psychiatrists where his hospital was located. A psychiatrist noted there are no incentives to become a psychiatrist because they comparatively they get paid much worse. He said incentives had to be provided to get more people into psychiatry versus other professions.

A psychiatric nurse I spoke to was the only nurse in her hospital, and had a full patient load to deal with. She said she lacked funds to do community outreach and to follow-up with patients where they live. Without community outreach, specialized care remains concentrated in district and sub-district hospitals, which can be out of reach for rural women.

### *Ineffective Referral System*

The referral system as stands places the onus on patients to make sure they receive appropriate care. If CHWs do not follow-up on referrals to the sub-district hospitals, and nurses are unaware of who has been referred, many patients will likely not receive care.

CHWs mentioned they issued referrals when they wanted patients to seek further care. However, mothers may not be able to frequently follow-up on referrals. One CHW noted the Ministry of Health provided referral slips, but it is unclear if they are actually used and tracked. Another noted that “not quite often” are referrals followed through to higher rungs of the health system. “Refer, Refer, Refer,” was presented during the CHW training to deal with certain cases. If treatment does stop with CHWs (who are largely untrained in psychotherapy), then there might be a much higher disease burden because mothers are unable to follow-up on treatments.

A clinician at a sub-district hospital, who is supposed to receive most referrals from CHWs, said she had only received one referral directly from a CHW. All her other patients came from within the hospital system. She said she had only seen one mother in her entire *career* that had depression. She herself said that she hardly knows any of the CHWs.

Another psychiatric nurse noted she had only encountered two patients with the “baby blues” during her 10 years at the hospital. She noted that she has no mechanism to follow-up on her referrals. All referrals she made were to the psychiatric hospitals at Kakamega and Mathari, but the onus was on patients to check back in with her. There was no follow-up to ensure they received care.

### *Mothers may not be seeking treatment for depression in clinics*

One psychiatric nurse reported that while most of the patients she saw suffered from depression (specifically bipolar depression), she hardly saw any mothers or expectant mothers.



This could indicate that many mothers do not visit clinics for depression treatments, possibly because they do not follow-up on referrals, they are undiagnosed, or stigma may prevent treatment. A psychologist noted that families might choose not to disclose a family-member's depression status because of stigma. He also said hospitals might discharge women with depression early because clinicians do not diagnose it. Families instead have to care for their relatives at home.

*Psychiatric Nurses are the highest-trained mental health professionals at lower levels of the health system*

In the absence of trained psychologists and psychiatrists at lower levels of the health system, psychiatric nurses provide the most comprehensive care available. Nurses have “taken over the role of a psychiatrist” in lower level hospitals because they are allowed to prescribe medication, according to a psychologist. Nurses end up seeing the brunt of mental health patients at these levels, he said, because doctors do not want to see them, or perhaps don't know what to do with them.

Another clinician said psychiatric nurses are the best equipped to diagnose and treat mental illnesses at secondary and primary care settings. Their training is extensive (over a year), and they can essentially function as psychiatrists in district hospitals since they prescribe medicine.

*Drugs used instead of psychosocial treatments or community outreach*

WHO recommends brief, structured psychosocial treatments as the first line of treatment for moderate to severe depression in low-resource settings (*WHO Mental Health Gap Action Programme (mhGAP) Intervention Guide* 2013). Providing anti-depressants is the fourth step of

the treatment protocol. Medication is not a preventative measure, and it can be prohibitively expensive for low-income patients.

Interviews revealed psychiatric nurses prefer to offer medication because they are time constrained. A clinician said nurses prescribe drugs to treat problems because they do not have enough time to do longer therapy sessions with all their patients. A nurse at a sub-district hospital said she had a mandate to prescribe medication. She could only do up to 30 minutes of therapy, if that. At the time, the hospital also had no anti-depressants left in stock. The nurse cited consistent drug shortages for the medication.

In the absence of community-outreach funds, nurses also cannot follow-up on their patients in the field. Drugs are the only way to offer consistent treatment without psychotherapy.

*Mental Health not prioritized at primary/secondary care levels, and clinicians are hardly trained*

A psychiatric nurse noted that doctors and non-psychiatric nurses do not prioritize mental health when patients visit hospitals. She said mental health may not be taken as seriously when clinicians have other, more pressing responsibilities like making sure women give birth without complications. In higher-income countries, the nurse noted that if a woman is crying, it is treated more seriously because everything else can generally be dealt with. But in her sub-district hospital, paying attention to a woman's feelings is secondary because there is a much higher risk of other complications.

A psychologist noted that diagnosing and recognizing mental illnesses is difficult in rural areas. Rural clinicians must look at all aspects of patients, and the presence of physical illnesses can mask a mental illness. A psychiatrist noted that a clinically depressed patient he treated may have been misdiagnosed by many other providers. Tuberculosis, malaria and typhoid fever were

often diagnosed because of the lethargy, headaches and other pains common to depression. These misdiagnoses occurred past primary care, after patients had seen many doctors. Until recently, the psychiatrist said medical students at his teaching hospital received no mental health training, while clinical officers (the equivalent of physician's assistants) still receive no training on mental health treatment. "The problem in this country is much wider than just a primary care problem," he said. He believed an effective long-term investment could be that every health worker at every level is trained to address mental health challenges, and is regularly re-trained. Every healthcare worker should be able to identify illnesses and carry out basic treatments, he believed.

#### *Role of religion in treating depression*

Health workers during usability testing were asked how they would counsel women who exhibited signs of depression. 15 of 20 participants said they would offer women some form of religious treatments, whether it was referring them to the Bible, instructing them to have faith or go to church, or referring them to church leaders for further treatment. Spirituality during counseling and prayer were common themes during other CHW interviews. They might advise women to believe in God, and that change will come eventually, since "change is a long-term process."

## Appendix E: Session Comprehension Quiz from Round 2

Correct answers are highlighted below.

<b>Person ID</b>		<b>Date</b>	
<b>Group</b>		<b>Observer</b>	

Please read each question and answer choices to the participant. The participant may read along. You should circle one answer per question based on what the participant says. Participants should complete this quiz without any other assistance. The quiz should not be administered in groups.

**1. What was the name of the new mother in the story?**

- a) Beatrice
- b) Mary
- c) Sharon

**2. How did the woman's family feel when the baby was born?**

- a) Sad
- b) Mad
- c) Happy

**3. How did the woman herself feel when the baby was born?**

- a) Sad
- b) Mad
- c) Happy

**4. What did the woman imagine herself doing if she did not have the baby?**

- a) Reading
- b) Eating
- c) Going to the market

**5. In this session, you learned that there are things a woman can do to make herself feel better.**

**We discussed three steps to feeling better. What is the first step?**

- a) Identify negative thoughts
- b) Take medication
- c) Try to ignore the feelings

**6. What is the second step in starting to feel better?**

- a) Try to ignore the feelings
- b) Take medication
- c) Replace unhealthy thoughts with healthy thoughts

**7. What is the last step in starting to feel better?**

- a) Take medication
- b) Practice healthy thinking and behavior
- c) Try to ignore the feelings