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Acceptability and feasibility of digital technology for training community health workers to deliver brief psychological treatment for depression in rural India

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ABSTRACT

Introduction: Digital technology offers opportunities to train community health workers to deliver psychological treatments towards closing the gap in existing mental health services in low-resource settings. This study explored the acceptability and feasibility of using digital technology for training community health workers to deliver evidence-based brief psychological treatment for depression in rural India.

Methods: This study consisted of two sequential evaluations of digital training prototypes using focus group discussions to explore community health worker perspectives about the digital training platform and the program content. Through an iterative design process, feedback was collected about the first prototype to inform modifications to the second prototype. Qualitative data was analyzed using a framework analysis approach.

Results: Thirty-two community health workers participated in three separate focus group discussions. Five overarching themes related to acceptability and feasibility of digital training revealed that training on detection and treatment of depression was considered important by study participants for addressing 'stress' and 'tension' within their communities, while the digital platform was viewed as useful and convenient despite limited familiarity with using digital technology. Moreover, participants suggested simple language for the program and use of interactive content and images to increase interest and improve engagement.

Discussion: Digital technology appears acceptable and feasible for supporting training of community health workers to deliver evidence-based depression care in rural India. These findings can inform use of technology as a tool for developing the clinical skills of community health workers for treating depression in low-resource settings.

1. Introduction

Depression is one of the leading causes of disease burden globally and disproportionately impacts low- and middle-income countries (World Health Organization, 2017). In India, the lifetime prevalence of depression was estimated at 5.25% and current prevalence was 2.7% among adults age 18 and older (Gururaj et al., 2016). Over 90% of individuals with depression in India do not receive adequate treatment (Patel et al., 2016). This treatment gap stems in part from a severe shortage of mental health providers (Mugisha et al., 2017). Task-sharing is a strategy that can expand the availability of mental health providers by shifting delivery of psychological treatments from specialist providers to non-specialist community health workers (Chibanda et al., 2016; Patel et al., 2011; Rahman et al., 2008; Raviola et al., 2019). One such intervention is the Healthy Activity Program (HAP), a brief psychological treatment for depression delivered by non-specialist counsellors that achieved moderate effect on reducing depressive symptoms and emerged as cost-effective in routine primary care attenders (Patel et al., 2017; Weobong et al., 2017).

An important bottleneck for disseminating evidence-based brief psychological interventions such as HAP is the need to train an adequate workforce for delivering these programs. In low- and middle-

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income countries, in-person didactic and supervised role-plays are most commonly utilized for training health workers (Singla et al., 2017). However, these teaching strategies are costly and require substantial personnel and logistic resources (Fairburn and Cooper, 2011). Innovative approaches are necessary to expand the mental health workforce, and web-based training is a solution that is potentially highly scalable (Fairburn and Cooper, 2011; Fairburn and Patel, 2014).

Much of the literature on digital technology, including mobile interventions and text messaging, has primarily been in the context of providing continuing educational support and training to community health workers on data collection and reporting, decision support, emergency referrals and work planning through alerts and reminders, as opposed to developing clinical skills (Winters et al., 2018; Woods et al., 2012). Digital interventions appear to have been effective for training community health workers in general health care delivery (Agarwal et al., 2015), though use of digital technologies for training community health workers to deliver psychological interventions, especially in settings in rural India, has received less attention (Barnett et al., 2018; Borkum et al., 2014; Modi et al., 2017; Naslund et al., 2019, 2017; Singla et al., 2017). The aim of this exploratory study was to determine the acceptability and feasibility of using digital technology to deliver a training program for developing the skills of community health workers, called Accredited Social Health Activists (ASHAs), to treat depression, by delivering HAP, in primary health care settings in Madhya Pradesh, India.

2. Methods

2.1. Iterative design process

This study employed an iterative design process involving two sequential phases of prototype testing and evaluation through focus group discussions with ASHA workers (see Fig. 1). Prototype 1.0 testing was carried out in February 2018. After prototype testing, qualitative feedback was collected from ASHAs to inform modifications to the training content and design for prototype 2.0. Prototype 2.0 testing occurred in July 2018, and was followed by additional focus group discussions with ASHAs. The time gap between these two sequential phases of testing and focus group discussions was necessary to allow time to review the qualitative findings from the first phase to inform modifications to the design for the prototype ahead of testing in the second phase. All ASHAs in this study completed written informed consent. Ethical review boards at Sangath, India and Harvard Medical School, United States approved all study procedures.

2.2. Sample and setting

This study was conducted in 3 community health centers (CHCs) in Sehore district in the state of Madhya Pradesh, India. Madhya Pradesh is a large, centrally located state with over 72 million people, of which nearly 73% reside in rural areas (Directorate of Census, 2011). The state has 51 district hospitals, 334 functional community health centers (Ministry of Health and Family Welfare, 2016), two mental hospitals and 14 medical colleges (Kokane et al., 2016). Only four urban metros and five districts are covered under the District Mental Health Program (Kokane et al., 2016), including Sehore district. We employed a convenience sampling approach to select the three CHCs where the ASHAs were recruited to participate in this study. Our research team works closely with the ASHA supervisors, and we contacted them to determine the availability of ASHA workers for participating in the prototype testing in this study. This was necessary in order to avoid creating unnecessary disruption in the regular workflow for the CHCs because many ASHA workers may have limited availability due to work-related obligations and responsibilities, and required attendance at government training programs, health campaigns, events and other field activities. The ASHA supervisors' were ideally positioned to recommend CHCs where ASHA workers were potentially available to participate in this study if interested. The study sample comprised ASHA workers, who are employed in the National Health Mission in India, recruited through a purposive sampling method. Coordinators and ASHA supervisors in

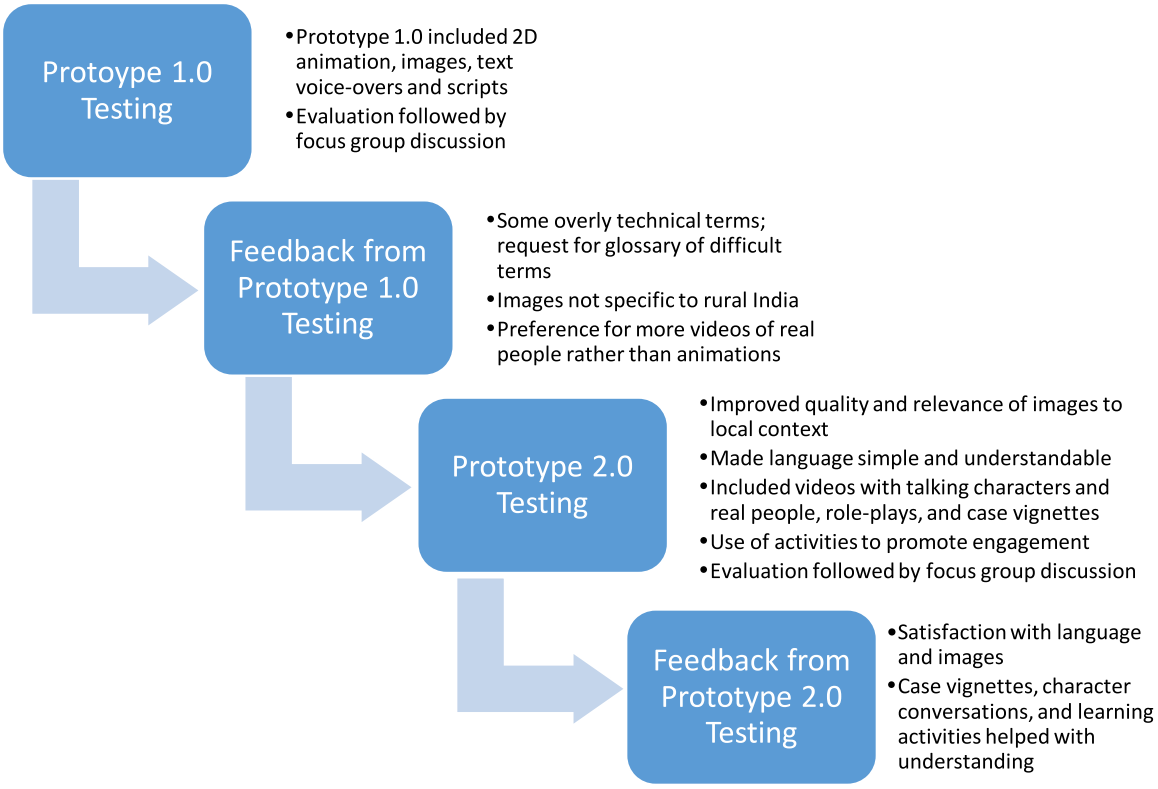

Fig. 1. Process of prototype testing and evaluation.

Sehore district sent information about the study to ASHAs who would be willing and available to participate.

2.3. Intervention

The initial prototypes of the digital training consisted of content related to introducing depression, screening for depression, and what is counselling and how it differs from a friendly chat. This content was adapted from the digital training website of the Healthy Activity Program (HAP) where the treatment manuals are available open source [http://premium.nextgenu.org/]. HAP is an evidence-based brief psychological treatment for moderate to severe depression designed for delivery in primary care settings by lay counsellors who do not have formal training in mental health care (Patel et al., 2017). HAP was selected in this study because it is a manualized psychological treatment adapted from behavioral activation, which is an effective approach for treating depression (Dimidjian et al., 2011) that is recommended by the WHO as part of mhGAP (World Health Organization, 2016). HAP was designed and tested in Goa state in India, and is supported with robust evidence showing its clinical effectiveness and cost-effectiveness for reducing depressive symptoms in primary care settings delivered by lay counselors (Patel et al., 2017). There is also evidence demonstrating the sustained effectiveness and cost-effectiveness of HAP, highlighting its potential for implementation within health systems in India (Weobong et al., 2017). Further, HAP has been adapted for delivery in other low resource settings, such as Nepal, where it has been used for treating depression among people receiving treatment for multidrug-resistant tuberculosis (Walker et al., 2018) and people with severe depression in primary care settings (Jordans et al., 2019).

The prototype content was uploaded to Moodle, an open-source online learning management system, for delivery on tablets, laptops or mobile phones. The content of the first prototype was presented as PowerPoint slides, animations, images, graphics, and voice-over narration. The second prototype was modified based on feedback from ASHAs, including adding more culturally relevant images and characters, and improving the quality of the graphics using Articulate 360 software. Additionally, various learning activities available through the Moodle platform, such as multiple-choice questions, drag and drop word selection tasks, matching words and phrases, and case vignettes were incorporated to make the second prototype more engaging and interesting to participants. The core content, however, remained unchanged across both prototypes. (A brief description of both prototypes is given in Table 1).

2.4. Prototype testing procedures

The prototypes were tested sequentially, where ASHAs assembled in a classroom style setting. The research team described the study goals and purpose of the digital training and focus group discussion. Three separate groups of ASHAs were recruited, with one group testing the first prototype and two groups testing the second prototype. The first prototype was delivered on tablets and mobile phones, and the second prototype was delivered on tablets, laptops and mobile phones. The research team demonstrated how to open and navigate the app. ASHAs were provided digital devices to use for the testing period and were asked to complete the digital training module on their own. Members of the research team were available to assist with technical difficulties or answer questions. Members of the team who developed the initial prototypes were not involved in the testing and evaluation process. Completion of the training session took 2–3 hours.

2.5. Data collection and analysis

After testing each prototype, qualitative researchers conducted a focus group discussion using a semi-structured focus group discussion guide. Each focus group discussion had 8–12 participants, were about 45 min in duration, and were facilitated by qualitative researchers from our team (SM and RDS) in Hindi, the local language, and audio-recorded and transcribed for thematic analysis. The focus group discussion guide was informed by the theory of change framework (Stein and Valters, 2012) and initially covered six topics related to satisfaction and perceived usefulness of the training, knowledge gained from the training, attitudes about depression, helping individuals with depression, and perspectives about ASHAs' role in the health system. After testing the first prototype, the guide was modified ahead of testing the second prototype. Greater emphasis was added on topics related to acceptability and feasibility of the digital platform, content of the training, and engagement with the course. These modifications were intended to capture changes made to the digital training program.

A framework analysis approach has been specifically developed for qualitative data analysis in applied policy analysis research (Bryman and Burgess, 1994). We followed the framework analysis approach and stages (Gale et al., 2013), which provided a systematic structure for the

Table 1
Description of Prototype 1.0 and Prototype 2.0 of the digital training program.

	Prototype 1.0	Prototype 2.0
Training delivered on	Tablet, Mobile	Tablet, Mobile, Laptop
Platform to deliver digital training content	Moodle	Moodle
No. of Modules	2	2
Course content	**Module 1: Understanding depression** Learning Objectives of Module 1 1. What is depression? 2. What are the symptoms of depression? 3. How to screen for symptoms of depression **Module 2: An introduction to Counseling** Learning Objectives of Module 2 1. What is meant by counseling? 2. What is the difference between counseling and a friendly chat?	**Module 1: Understanding depression** Learning Objectives of Module 1 1. What is depression? 2. What are the symptoms of depression? 3. How to screen for symptoms of depression **Module 2: An introduction to Counseling** Learning Objectives of Module 2 1. What is meant by counseling? 2. What is the difference between counseling and a friendly chat?
Presentation of content	Contents delivered using PowerPoint videos consisting of animation, images, graphics, and voice-over	Contents delivered using combination of PowerPoint videos and human videos. PowerPoint videos consisted of culturally relevant images and characters designed by in-house artists, better quality graphics (designedusing an authoring tool for improving the quality of digital content, such as better color quality and smooth transitions, and improved interactivity of content using Articulate 360 software)
Engagement strategies	Have not included specific learning engagement strategies	Review of existing online courses and Moodle features to include learning engagement strategies such as multiple-choice questions, drag and drop word selection tasks, matching words and phrases, and case vignettes

analysis process, with visible stages making it possible to clearly follow how the results were obtained from the data (Lacey and Luff, 2001). Additionally, this approach allows for the use of a priori and emergent codes in the analysis process (Lacey and Luff, 2001).

An a priori coding framework was developed covering topics related to acceptability and feasibility of the digital platform and perceptions about depression, as these topics were covered in the focus group discussions. The framework analysis began with a process of familiarization with the data, where two authors (SM & RDS) carefully listened to the audio-recordings and prepared a list of key topics as they related to our pre-defined set of themes. The list of topics was translated from Hindi into English. This same process was repeated following testing of each prototype. Next, three researchers (SM, RDS, & JAN) reviewed the topics identified across the focus group discussions and grouped these topics into common themes with relevance for further informing digital intervention design. In this process, referred to as charting, the researchers engaged in multiple rounds of discussion to reach consensus about the final list of themes. These included overall perceived acceptability of the digital training, feasibility of using digital technology, and suggested revisions to improve the content, language, and user engagement.

3. Results

3.1. Sample characteristics

In total, 32 ASHAs participated in three separate groups across two phases. Eight ASHAs from the Doraha Community Health Center participated in prototype 1.0 testing and 24 ASHAs, including 11 from the Ahmadpur Primary Healthcare Center and 13 from the Ashta Civil Hospital, participated in prototype 2.0 testing. Participant characteristics are listed in Table 2. All participants were women, most were age 24 to 35 years, half had 11 years of education or higher, and nearly half (43.8%) had 5 years or less work experience.

3.2. Qualitative findings

The focus group discussions revealed five themes described below and summarized in Table 3.

3.2.1. Importance of depression training

According to ASHAs across all three focus group discussions, training about how to identify and treat depression was seen as useful for helping their community address prominent concerns of stress, “tension” (a local metaphor for common mental health problems), and other symptoms of depression. Importantly, the ASHAs, who did not have prior clinical training about depression, could relate to challenges of addressing symptoms of depression, especially among their female patients:

> “As much as I learned in this training, I understand one thing that ladies experience depression more as compared to men. And this is a true thing because women have to face tension of both sides from their in-law's side as well as their maternal family side… according to my understanding women suffer from depression more as sometimes they have to face domestic violence, discrimination and they have been beaten up, this makes them more suffered”.

One ASHA reported that receiving training about depression could help her with providing help on time, which could even save the life of someone facing challenges of depression:

> “One of my relatives recently died. In my mind now, I am thinking after reading this (about depression in the training) that she perhaps died due to this stress only, she committed suicide by hanging herself and she died. If she could get treatment on time she could have been saved. If she could have been taken care of, perhaps she would have been saved”.

This training can also potentially help ASHAs give advice to individuals in their community about seeking the right treatment for depression:

> “People of the village usually go to seek spiritual help for mental illnesses but now with the help of this (training), we can make them understand and become aware, that the treatment is first and must”.

ASHAs also found this training useful for themselves, as they can face stress and tension at many times in their work:

> “The information provided here (in training) I liked most, as ASHA stays in the depression (sic) more than anyone else. We live in the village, we do not get information. We just run and come for the training to get the information because we ourselves are experiencing this and that is why we are always ready to help others too”.

3.2.2. Acceptability of digital training

Learning on the digital platform appeared to be a positive experience for several ASHAs. This was reflected when they talked about the value of learning using digital technology as this can give them freedom to learn and re-learn different aspects of the course content at their own pace. ASHAs indicated that they can learn the course whenever they will get free time and can revisit course content anytime if they forget something:

> “In face to face training if we get confused on the topic and if we forget it we can’t do anything about it, but in digital training, we can go back as many times we want and learn”.

The digital training program could also help ASHAs explain depression, its symptoms and importance of seeking treatment to their patients, or elderly caregivers, by using the mobile device with pictures and stories:

> “The course on the tablet could be helpful while educating others and creating awareness at an individual level about depression socially to aged people as well as adults in the community”.

ASHAs also mentioned that digital training could save time and costs that are typically spent on travelling to attend in-person trainings, including their time, lodging, food, venue and cost of trainers:

> “The biggest thing is, it is time-saving and money saving. It will save money. Our money as well as the government’s money. The government has to spend so much money on arranging 4–5 days training for ASHAs; now with the help of this digital training it will save both money and time”.

The ASHAs also described the convenience of the digital training program, because they would no longer need to spend time away from their family for several days to attend in-person trainings, where they often worried about their family while away:

> “We had to stay away for 4–5 days from our house to attend the

Table 2
Characteristics of the ASHAs participating in the evaluation of prototype 1.0 and prototype 2.0 of the digital training program.

Socio-demographic Characteristics		Sample (n = 32)	
		n (%)	Mean (SD)
Age	24-35	25 (78.1%)	31.72 (4.77)
	35-45	7 (21.9%)	
Education (in years)	8-10	16 (50.0%)	11.15 (2.47)
	11 and above	16 (50.0%)	
Work Experience (in years)	1-5	14 (43.8%)	6.34 (3.30)
	6-10	11 (34.4%)	
	10 and above	7 (21.9%)	

Table 3
Key findings from ASHA perspectives following the evaluation of prototype 1.0 and prototype 2.0 of the digital training program.

Themes	Key Findings
Importance of depression training	• Depression is prominent in the community • Training is helpful in educating/counselling people about depression and appropriate treatment
Acceptability of digital training	• Freedom to learn the course • Time and money saving • Easy access to the course contents • Re-visit the course content and re-learn • Can stay at home with family and learn the course
Feasibility of using digital technology	• Learning the course on digital platform appeared interesting • Low understanding about how to use digital devices • Training to use the digital device would help to learn the course content • Technical issues of digital devices: poor audio quality, slow speed of the device, poor internet connectivity • Offline trainings could address the issue of internet connectivity
Content and language of the digital training	• Initial language included technical terms about depression and counselling that were difficult to understand • Updated language was easy to understand, and was perceived by ASHAs as their 'own language' • Initial content needed to include videos of real-life characters and images representative of rural context • Updated images, videos, and graphics were considered relevant to the context (e.g., use of images to show symptoms of depression)
Engagement with digital training	• Learning activities were incorporated to promote engagement, these included case vignettes, drag and drop response options, and choosing answers to questions, which the ASHAs liked • Learning through pictures, stories and conversation between ASHAs and nurses at a health facility was considered a helpful technique for learning the program content

training. Now we can stay at home and with family and take training too".

3.2.3. Feasibility of using digital technology

Limited familiarity with using digital devices among ASHAs emerged as one challenge, which can be addressed with additional instruction. In each round of prototype testing, the ASHAs accessed the digital training platform and learned to use the platform with ease when they were provided additional instruction about the different features of the device and how to access the content on the device:

> "We didn't know how to use it. For the first time, we were learning it. Once training on using a tablet or phone will be provided for each ASHA then everyone will learn how to operate it, then it would be very easy for us to complete it".

Several technical issues occurred during the prototype testing, and these were mentioned by ASHAs. These included interrupted and slow internet, slow speed of the devices, and poorly functioning touchscreen:

> "Tablet was slow and hanging again and again that we felt bored".

Other ASHAs mentioned low sound quality as a concern:

> "Audio was not audible, we were hardly getting to listen to anything, we had to put our phone over our ears to listen to it".

Some ASHAs also suggested making the course available offline to remove some technical challenges:

> "Some CD system should be available to play so that it will run smoothly. Internet connectivity issue should not be there"

3.2.4. Content and language of digital training

When testing the first prototype, the ASHAs found some technical terms about depression or counselling difficult to understand:

> "There are a few words used somewhere which are difficult to understand for instance "Alochanatmak vyavhar" (critical behavior), and "Nirashawaadi" (pessimistic). These are very technical and difficult words to understand, it could be difficult to make people understand using such heavy jargon so if it can be taught to us in easier language then it would be great".

The ASHAs suggested that synonyms could be given covering difficult terms and words:

> "So if we could use different words for the same word. If we can pick some different word in place of the same word to make it more understandable. In my suggestion, there should be a word or more than one word which is easy to learn and quick to remember".

The ASHAs commented that the pictures should include greater rural representation of people and places to make the course more specific to their context:

> "The pictures which were used were not the perfect match with the language they were speaking in the video. Pictures and the expression were not appropriate and were not matching/connecting".

To make the course content more interesting, ASHAs suggested including videos of real persons teaching the course:

> "There were cartoons used in the video, if we could use any real person instead of that, suppose me (ASHA) or someone like me could be there in the videos can be more real and connecting to the women in the village".

The second prototype incorporated the ASHAs' recommendations and initial feedback from the first prototype. In the evaluation of the second prototype, ASHAs appeared to find the modified language easy to understand and indicated, "it was their own language":

> "Language which ASHA and ANM (auxiliary nurse midwife) were speaking in the video was very simple and easy to understand. The conversation they both were having was same as we do in reality. So it was very convenient for us to understand and we did not have any difficulty to understand it. The language used in the audio and video can be understood by both city as well as village women".

The ASHAs also appreciated the new images, videos and graphics included in the second prototype. For example, images were used to explain symptoms of depression:

> "The images which were shown in the video were too nice, in the images, someone was holding his head, someone was staying silent and the type of expression shown was very connecting to us as it gave us a sense that what was it all about, and we could understand what was wrong with them and what difficulties they were facing."

3.2.5. Engagement with the digital training

When testing the first prototype, participants appeared distracted,

as they were talking to each other and were going out and coming back into the classroom. This suggested that participants may have had low engagement with the training content. As part of revising the second prototype, additional learning activities to promote engagement were incorporated by drawing from existing online courses using the Moodle platform. This included case vignettes and quizzes with different response options. When testing the second prototype, ASHAs appeared more engaged, for example they expressed that completing activities with drag and drop response options kept them interested in learning the content:

> "We were lifting the one option and trying to keep it in the blank space, it was too much fun. If the answer was wrong it was not getting fixed in given blank space, so we could understand what was the right answer, which again helped us in understanding the topic".

Additionally, ASHAs indicated that learning through pictures, stories and role-play conversations were helpful techniques for learning the content:

> "Stories of Rachna and Govind, Drag and Drop activity, choosing answers to questions were very connecting".

> "Learning through pictures, stories and conversation between ASHA and nurse at a health facility was the most learnable thing for us".

4. Discussion

This study explored the acceptability and feasibility of two sequential prototypes of a digital training program for ASHAs to deliver an evidence-based psychological treatment for depression. Areas of assessment were the acceptability of the training content and digital platform for ASHAs, and their engagement with the program and perceived usefulness of learning about depression. Thematic analysis of focus group discussions yielded five themes: importance of depression training; acceptability of digital training; feasibility of using digital technology; content and language of digital training; and engagement with digital training. The study findings suggested that ASHAs found the digital training program acceptable for learning new content and feasible to use. ASHAs' limited prior experience of using digital devices was one key challenge faced during the training. ASHAs also recommended using simple language, synonyms for difficult words, contextually specific images, and interactive content in order to make the training more interesting and engaging.

ASHAs in this study reported that based on their observations and their interactions with individuals from their communities, that many people suffer from stress and tension. ASHAs also indicated that training about depression would be useful for helping individuals seek early treatment, and perhaps even prevent serious crises if treatment is received in time. This is noteworthy because it suggests that ASHAs recognize the importance of training about depression, which could address demand for such interventions in community settings. Similarly, in the VISHRAM study, delivery of HAP by lay health workers in a rural population of India showed improvements in community understanding of depression and willingness to seek treatment (Shidhaye et al., 2017).

Digital technology has increasingly been found beneficial for facilitating the training and supervision of community health workers, and supporting health care delivery in low- and middle income countries (Long et al., 2019; Mishra et al., 2019; Rahman et al., 2019). For example, recent studies suggest that digital technology can improve efficiency in training, personnel management, communication and health service coverage among community health workers (Long et al., 2019; Mishra et al., 2019). One recent study conducted in New Delhi, India demonstrated that an online course appeared feasible and acceptable for training school teachers and counselors for screening, delivering brief interventions, and supporting the prevention and management of behavioral addictions involving Internet use among school students (Balhara and Singh, 2019). In another recent study, Rahman et al. (2019), found that technology assisted training appears equally effective as face-to-face training in terms of achieving clinical competencies for delivering perinatal depression care by community health workers in Pakistan (Rahman et al., 2019). Similarly, in the current study, ASHAs showed acceptability towards digital training and found it potentially feasible in their practice. They suggested that digital training could be more efficient compared to traditional in-person training as it could save their travel time, costs to the government, and stress of staying away from family for several days to attend trainings. This is consistent with prior studies, where digital interventions have shown acceptability and feasibility for use among community health workers in diverse settings for outcome monitoring and data collection (Chaiyachati et al., 2013; Chang et al., 2013; Little et al., 2013; Medhanyie et al., 2015). Additionally, in the study by Balhara and Singh (2019), after completion of the online course, participating school teachers and counselors showed increases in their knowledge, skills, and capacity to screen, deliver brief intervention, and refer cases of behavioral addictions involving problematic Internet use (Balhara and Singh, 2019). However, prior studies have cautioned that despite positive reception towards digital interventions among community health workers, uptake of these programs in practice has been low as reflected by incomplete reporting for digital interventions in South Africa (Chaiyachati et al., 2013) and Uganda (Haberer et al., 2010). While in this study, ASHAs may find digital training about depression interesting at first, they might not complete the training over time, or learn the course content as expected. Therefore, it is critical to monitor ASHA participation in the digital learning program, and to incorporate approaches for promoting engagement and successful completion of the program.

Limited experience with using digital technology among ASHAs emerged as a common challenge in this study making it difficult for them to access and navigate the training on a digital platform without assistance from the study team. This type of challenge has been reported previously, and can potentially be addressed by providing training to community health workers on using digital devices (Medhanyie et al., 2015). Importantly, in India, training community health workers using digital technology and scaling up digital training programs is likely feasible as part of future efforts because ASHAs and other community health workers will be trained in information technology (IT) under the Government of India's initiative of the National Digital Literacy Mission (Ministry of Electronics and Information Technology, 2018). Technical challenges, such as poor internet connectivity, non-responsive device screens, and slow device speed have also been observed in other digital intervention studies (Medhanyie et al., 2015). For example, Medhanyie et al. (2015) reported 'digital bottlenecks' including short battery life of smartphones, insensitivity of the phones' touch screens with time and poor mobile network connectivity were common concerns in their study using mobile applications to collect maternal health data in Ethiopia. In order to address the challenge of unstable internet connectivity in digital training, in the recent study carried out by Rahman et al. (2019), they employed an offline tablet-based application not requiring wireless access, which can enhance the feasibility of this approach for training community health workers in remote regions (Rahman et al., 2019). This highlights the importance of selecting appropriate digital devices and applications for delivering the intended content, and that these interventions can function offline or within network connectivity constraints of the target setting.

Feedback from ASHAs on course content and engagement suggested that use of interactive videos with context-specific characters, simple language, illustrative images, case vignettes and learning activities can make the content more interesting, engaging and easy to understand. Presenting digital content in an interactive rich media format may help participants better learn the intervention while offering potential to

improve outcomes (Florez-Arango et al., 2011). Importantly, carefully considering the perspectives of ASHAs in the iterative design and delivery of the digital learning content could help ensure that they better engage with the intervention, learn the content more effectively and gain the necessary clinical competencies for detecting and treating depression in their work in the community.

The small sample size and limited learning content was a limitation with this study, and thus the findings need to be interpreted cautiously and may not generalize to the larger ASHA workforce from diverse regions across India. The study setting was also a limitation because the prototype testing was conducted in community health centers. This classroom style setting may have been supportive for helping ASHAs learn the content. Real-world acceptability and feasibility of training ASHAs using digital technology will need more definitive assessment when a larger pool of ASHAs complete the full training within their homes and communities. Furthermore, we recognize that additional forms of data could help supplement these current preliminary findings and expand our understanding of acceptability of digital training programs for ASHAs. For example, in our future work, it will be important to capture data directly from the digital learning management system (i.e., Moodle platform) showing the length of time to complete the program, difficulty completing different sections of the training content, and then triangulating these findings with qualitative feedback as well as quantitative measures of knowledge and skill acquisition.

5. Conclusion

This study provides initial evidence supporting the acceptability and demand for digital training about psychological treatments for depression among community health workers in India. The digital platform appeared useful for supporting training of ASHAs, in terms of potential time and cost savings, convenience, and freedom to learn at their own pace. This study contributes to growing research on the acceptability and feasibility of using digital technology for supporting community health workers in delivering mental health interventions in diverse settings, as highlighted in a recent review summarizing seven studies from low- and middle-income countries and potential challenges (Naslund et al., 2019), and offers important insights to guide future intervention development.

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Declaration of Competing Interest

The authors declare no competing interests.

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References

Agarwal, S., Perry, H.B., Long, L., Labrique, A.B., 2015. Evidence on feasibility and effective use of mH ealth strategies by frontline health workers in developing countries: systematic review. Trop. Med. Int. Health 20, 1003–1014.

Balhara, Y.P.S., Singh, S., 2019. Online course on basics of management of behavioral addictions involving use of internet: observations from the first batch of participants. Asian J. Psychiatr. 44, 1–3. https://doi.org/10.1016/j.ajp.2019.07.013.

Barnett, M.L., Gonzalez, A., Miranda, J., Chavira, D.A., Lau, A.S., 2018. Mobilizing community health workers to address mental health disparities for underserved populations: a systematic review. Adm. Policy Ment. Heal. Ment. Heal. Serv. Res. 45, 195–211. https://doi.org/10.1007/s10488-017-0815-0.

Borkum, E., Rotz, D., Rangarajan, A., 2014. Midline Findings from the Evaluation of the Ananya Program in Bihar. Rep. Submitt. To.

Bryman, A., Burgess, R.G., 1994. Analyzing Qualitative Data. Routledge.

Chaiyachati, K.H., Loveday, M., Lorenz, S., Lesh, N., Larkan, L.-M., Cinti, S., Friedland, G.H., Haberer, J.E., 2013. A pilot study of an mHealth application for healthcare workers: poor uptake despite high reported acceptability at a rural South African community-based MDR-TB treatment program. PLoS One 8, e64662.

Chang, L.W., Njie-Carr, V., Kalenge, S., Kelly, J.F., Bollinger, R.C., Alamo-Talisuna, S., 2013. Perceptions and acceptability of mHealth interventions for improving patient care at a community-based HIV/AIDS clinic in Uganda: a mixed methods study. AIDS Care 25, 874–880.

Chibanda, D., Weiss, H.A., Verhey, R., Simms, V., Munjoma, R., Rusakaniko, S., Chingono, A., Munetsi, E., Bere, T., Manda, E., 2016. Effect of a primary care–based psychological intervention on symptoms of common mental disorders in Zimbabwe: a randomized clinical trial. Jama 316, 2618–2626.

Dimidjian, S., Barrera, M., Martell, C., Muñoz, R.F., Lewinsohn, P.M., 2011. The origins and current status of behavioral activation treatments for depression. Annu. Rev. Clin. Psychol. 7, 1–38. https://doi.org/10.1146/annurev-clinpsy-032210-104535.

Directorate of Census, 2011. Census of India 2011: Madhya Pradesh.

Fairburn, C.G., Cooper, Z., 2011. Therapist competence, therapy quality, and therapist training. Behav. Res. Ther. 49, 373–378.

Fairburn, C.G., Patel, V., 2014. The global dissemination of psychological treatments: a road map for research and practice. Am. J. Psychiatry 171, 495–498.

Florez-Arango, J.F., Iyengar, M.S., Dunn, K., Zhang, J., 2011. Performance factors of mobile rich media job aids for community health workers. J. Am. Med. Inform. Assoc. 18, 131–137.

Gale, N.K., Heath, G., Cameron, E., Rashid, S., Redwood, S., 2013. Using the Framework Method for the Analysis of Qualitative Data in Multi-disciplinary Health Research. https://doi.org/10.1186/1471-2288-13-117.

NMHS collaborators group,Gururaj, G., Varghese, M., Benegal, V., Rao, G.N., Pathak, K., Singh, L.K., Mehta, R.Y., Ram, D., Shibukumar, T.M., Kokane, A., Lenin Singh, R.K., Chavan, B.S., Sharma, P., Ramasubramanian, C., Dalal, P.K., Saha, P.K., Deuri, S.P., Giri, A.K., Kavishvar, A.B., Sinha, V.K., Thavody, J., Chatterji, R., Akoijam, B.S., Das, S., Kashyap, A., Ragavan, V.S., Singh, S.K., Misra, R., 2016. National Mental Health Survey of India, 2015–16: Prevalence, Pattern and Outcomes Bengaluru. National Institute of Mental Health and Neuro Sciences, NIMHANS Publication No. 129.

Haberer, J.E., Kiwanuka, J., Nansera, D., Wilson, I.B., Bangsberg, D.R., 2010. Challenges in using mobile phones for collection of antiretroviral therapy adherence data in a resource-limited setting. AIDS Behav. 14, 1294–1301. https://doi.org/10.1007/s10461-010-9720-1.

Jordans, M.J.D., Luitel, N.P., Garman, E., Kohrt, B.A., Rathod, S.D., Shrestha, P., Komproe, I.H., Lund, C., Background, V.P., 2019. Effectiveness of Psychological Treatments for Depression and Alcohol Use Disorder Delivered by Community-based Counsellors: Two Pragmatic Randomised Controlled Trials Within Primary Healthcare in Nepal. https://doi.org/10.1192/bjp.2018.300.

Kokane, A.M., Chatterji, R., Pakhare, A., Ray, S., Mittal, P., Arvind, B.A., Rao, G.N., Singh, A.R., Krisha Prasad, S.R.N., 2016. National Mental Health Survey, Madhya Pradesh State Report 2015-2016.

Lacey, A., Luff, D., 2001. Trent Focus for Research and Development in Primary Health Care Qualitative Data Analysis. Trent Focus.

Little, A., Medhanyie, A., Yebyo, H., Spigt, M., Dinant, G.-J., Blanco, R., 2013. Meeting community health worker needs for maternal health care service delivery using appropriate mobile technologies in Ethiopia. PLoS One 8, e77563.

Long, L.-A., Pariyo, G., Kallander, K., 2019. Digital Technologies for Health Workforce Development in Low-and Middle-Income Countries: A Scoping Review. n.d.. .

Medhanyie, A.A., Moser, A., Spigt, M., Yebyo, H., Little, A., Dinant, G., Blanco, R., 2015. Mobile health data collection at primary health care in Ethiopia: a feasible challenge. J. Clin. Epidemiol. 68, 80–86.

Ministry of Electronics and Information Technology, 2018. Review of National Digital Literacy Mission (NDLM): Problems and Challenges.

Ministry of Health and Family Welfare, 2016. Rural Health Statistics. n.d.. data.gov.in [WWW Document]. URL https://data.gov.in/catalog/rural-health-statistics-2016?filters%5Bfield_catalog_reference%5D=2005921&format=json&offset=0&limit=6&sort%5Bcreated%5D=desc (Accessed 7.22.19).

Mishra, S.R., Lygidakis, C., Neupane, D., Gyawali, B., Uwizihiwe, J.P., Virani, S.S., Kallestrup, P., Miranda, J.J., 2019. Combating non-communicable diseases: potentials and challenges for community health workers in a digital age, a narrative review of the literature. Health Policy Plan. 34, 55–66. https://doi.org/10.1093/heapol/czy099.

Modi, D., Desai, S., Dave, K., Shah, S., Desai, G., Dholakia, N., Gopalan, R., Shah, P., 2017. Cluster randomized trial of a mHealth intervention "ImTeCHO" to improve delivery of proven maternal, neonatal, and child care interventions through community-based Accredited Social Health Activists (ASHAs) by enhancing their motivation and strengthening. Trials 18, 270. https://doi.org/10.1186/s13063-017-1998-0.

Mugisha, J., Abdulmalik, J., Hanlon, C., Petersen, I., Lund, C., Upadhaya, N., Ahuja, S., Shidhaye, R., Mntambo, N., Alem, A., 2017. Health systems context (s) for integrating mental health into primary health care in six Emerald countries: a situation analysis. Int. J. Ment. Health Syst. 11, 7.

Naslund, J.A., Aschbrenner, K.A., Araya, R., Marsch, L.A., Unützer, J., Patel, V., Bartels, S.J., 2017. Digital technology for treating and preventing mental disorders in low-income and middle-income countries: a narrative review of the literature. Lancet Psychiatry 4, 486–500.

Naslund, J.A., Shidhaye, R., Patel, V., 2019. Digital technology for building capacity of nonspecialist health workers for task sharing and scaling up mental health care globally. Harv. Rev. Psychiatry 1. https://doi.org/10.1097/hrp.0000000000000217.

Patel, V., Xiao, S., Chen, H., Hanna, F., Jotheeswaran, A.T., Luo, D., Parikh, R., Sharma, E., Usmani, S., Yu, Y., 2016. The magnitude of and health system responses to the

mental health treatment gap in adults in India and China. Lancet 388, 3074–3084.
Patel, V., Weiss, H.A., Chowdhary, N., Naik, S., Pednekar, S., Chatterjee, S., Bhat, B., Araya, R., King, M., Simon, G., 2011. Lay health worker led intervention for depressive and anxiety disorders in India: impact on clinical and disability outcomes over 12 months. Br. J. Psychiatry 199, 459–466.
Patel, V., Weobong, B., Weiss, H.A., Anand, A., Bhat, B., Katti, B., Dimidjian, S., Araya, R., Hollon, S.D., King, M., 2017. The Healthy Activity Program (HAP), a lay counsellor-delivered brief psychological treatment for severe depression, in primary care in India: a randomised controlled trial. Lancet 389, 176–185.
Rahman, A., Akhtar, P., Hamdani, S.U., Atif, N., Nazir, H., Uddin, I., Nisar, A., Huma, Z., Maselko, J., Sikander, S., Zafar, S., 2019. Using technology to scale-up training and supervision of community health workers in the psychosocial management of perinatal depression: a non-inferiority, randomized controlled trial. Glob. Ment. Health 6, 1–12. https://doi.org/10.1017/gmh.2019.7.
Rahman, A., Malik, A., Sikander, S., Roberts, C., Creed, F., 2008. Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial. Lancet 372, 902–909.
Raviola, G., Naslund, J.A., Smith, S.L., Patel, V., 2019. Innovative models in mental health delivery systems: task sharing care with non-specialist providers to close the mental health treatment gap. Current Psychiatry Reports 21 (44). https://doi.org/10.1007/s11920-019-1028-x.
Shidhaye, R., Murhar, V., Gangale, S., Aldridge, L., Shastri, R., Parikh, R., Shrivastava, R., Damle, S., Raja, T., Nadkarni, A., 2017. The effect of VISHRAM, a grass-roots community-based mental health programme, on the treatment gap for depression in rural communities in India: a population-based study. Lancet Psychiatry 4, 128–135.
Singla, D.R., Kohrt, B.A., Murray, L.K., Anand, A., Chorpita, B.F., Patel, V., 2017. Psychological treatments for the world: lessons from low-and middle-income countries. Annu. Rev. Clin. Psychol. 13, 149–181.
Stein, D., Valters, C., 2012. Understanding Theory of Change in International Development.
Walker, I.F., Khanal, S., Hicks, J.P., Lamichhane, B., Thapa, A., Elsey, H., Baral, S.C., Newell, J.N., 2018. Implementation of a Psychosocial Support Package for People Receiving Treatment for Multidrug-resistant Tuberculosis in Nepal: a Feasibility and Acceptability Study. https://doi.org/10.1371/journal.pone.0201163.
Weobong, B., Weiss, H.A., McDaid, D., Singla, D.R., Hollon, S.D., Nadkarni, A., Park, A.-L., Bhat, B., Katti, B., Anand, A., 2017. Sustained effectiveness and cost-effectiveness of the Healthy Activity Programme, a brief psychological treatment for depression delivered by lay counsellors in primary care: 12-month follow-up of a randomised controlled trial. PLoS Med. 14, e1002385.
Winters, N., Langer, L., Geniets, A., 2018. Scoping review assessing the evidence used to support the adoption of mobile health (mHealth) technologies for the education and training of community health workers (CHWs) in low-income and middle-income countries. BMJ Open 8, e019827.
Woods, D., Attwell, A., Ross, K., Theron, G., 2012. Text messages as a learning tool for midwives. S. Afr. Med. J. 102.
World Health Organization, 2016. mhGAP Intervention Guide for Mental, Neurological and Substance Use Disorders in Non-specialized Health Settings: Mental Health Gap Action Programme (mhGAP), Version 2.0.
World Health Organization, 2017. WHO | Depression and Other Common Mental Disorders. WHO.