Challenges and mitigation strategies in the development, usability testing, and implementation of a digital mental health intervention for depression (VMood) in Vietnam: A feasibility study

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Submitted to: JMIR Formative Research
on: November 01, 2024

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Abstract

Background: Worldwide, the COVID-19 pandemic has contributed to further gaps in mental health care, particularly in low- and middle-income countries such as Vietnam, where care is inaccessible for 83% of those who need it. In response, there has been an explosion of digital mental health interventions, such a s smartphone apps. Presently, the evidence for such interventions is limited, especially where they have been adapted from evidence-based in-person formats.

Implementation science aims to promote the uptake of scientific findings into practice. A key determinant of implementation success is an intervention's usability. Hurdles to usability include an intervention being too confusing or time-intensive to use. Facilitators include incorporating a greater number of engagement features and integrating human support.

Objective: The aim of this implementation science feasibility study is to describe the challenges and mitigation strategies used in the development, usability testing, and implementation of a digital depression intervention (VMood smartphone app) developed in Vietnam. VMood was adapted from an evidence-based in-person intervention originally developed in Canada that is grounded in principles of Cognitive Behavioural Therapy, with supportive coaching by a nonspecialist provider. The research team is currently testing the effectiveness and cost-effectiveness of VMood in a randomized controlled trial (RCT) across eight provinces in Vietnam, informed by results from this feasibility study.

Methods: This mixed methods feasibility study was informed by Proctor et al.,'s Implementation Outcomes Framework, focusing on acceptability, adoption, appropriateness, and feasibility. This study involved three data collection components: 1) usability testing (interviews and focus groups with app user and provider participants who tested VMood in one Vietnamese province; 2) app metrics (from the early phase of the RCT in the same province but from different municipalities); and 3) discourse data (notes from various team meetings, communications, and reports on VMood's development and implementation). Qualitative data were analyzed using thematic content analysis. App usage data were analyzed using basis descriptive statistics.

Results: Findings from the three data components showed there were seven main challenges that fell within Proctor et al.,'s Framework: 1) challenges with recruitment and uptake of the app; 2) challenges with utilization and engagement; 3) screening challenges; 4) digital divide; 5) limitations to digital applications for mental health; 6) technological challenges; and 7) funding and policy constraints. Various solutions to help mitigate the challenges were utilized by the team.

Conclusions: Adjustments based on recommendations critical to VMood's usability and implementation were made to the VMood intervention that is currently being tested in the RCT. Findings from this study have applicability for others looking to develop and implement similar digital interventions. Clinical Trial: The larger RCT is registered at ClinicialTrials.gov, identifier

[NCT05783531].

(JMIR Preprints 01/11/2024:68297)
DOI: https://doi.org/10.2196/preprints.68297

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Keywords: digital mental health; depression; implementation science; usability; low- and middle-income countries (LMICs); Vietnam

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Introduction

Background

Mental disorders are a leading cause of global disease burden,[1] with approximately 1 in every 8 people living with a mental disorder in 2019.[2] The urgency to improve access to mental health care is a global priority and has been further magnified within the context of the COVID-19 pandemic, which has contributed to deteriorations in population mental health.[3] The Global Burden of Disease 2020 study estimated the pandemic has led to increases of 28% for major depressive disorders and 26% for anxiety disorders,[3] two of the most common mental disorders.[4] The COVID-19 pandemic has also illuminated critical and inequitable gaps in care, with severe disruptions to already limited in-person services.[5] These impacts have had a profound impact globally but particularly so in low- and middle-income countries (LMICs) such as Vietnam, where mental health care is inaccessible for 83% of those who need it.[6] There has in response been an explosion of mental health interventions delivered through digital means, such as smartphone apps, as they have emerged as a promising way to expand access to care within the additional constraints imposed by the COVID-19 pandemic. Presently, the evidence for such interventions is limited[7,8], particularly where digital interventions have been adapted from evidence-based in-person formats.[9]

Implementation science aims to promote the uptake of scientific findings and other evidence-based approaches into practice to improve health services.[10] A key determinant of implementation success is an intervention's usability.[11] Usability is the extent to which a product can be used easily, effectively, and with satisfaction to obtain specified goals.[12] Usability has been commonly referred to as a key factor in the successful implementation and sustainability of digital health apps,[13] with poor usability being a primary reason for failed adoption.[14] Approximately one-third of users who download health apps stop using them after a short time,[15] often no more than two weeks.[16] Hurdles to app usability include them being 'too confusing to use', requiring too much time to enter data, or small screens that display limited information at a time.[14] An additional consideration for individuals with depression include specific symptoms of depression such as low motivation, concentration difficulties, and behavioural avoidance that may make it more difficult for them to engage with digital health interventions, posing further challenges to real-world efficacy.[17] Facilitators include incorporating a greater number of engagement features (e.g., praises, reminders)[18] and integrating human support.[19] Usability is intricately linked with acceptability, which includes the intuitive attitudes towards the intervention, usage intentions, actual usage, and satisfaction after using.[20] Acceptability is deeply contextualized and intricately linked with prevailing social and cultural norms.[21]

Goal of This Study

The aim of this implementation science feasibility study is to describe the challenges in the development, usability testing, and implementation of a digital depression intervention (VMood smartphone app) adapted from an in-person format in Vietnam, along with mitigation strategies for how the research team addressed them. Specific objectives are to:

1. Examine the challenges to the process of adapting an in-person depression intervention to a digital format (VMood app) in terms of acceptability, adoption, and appropriateness;
2. Describe the strategies the team utilized to mitigate and address the challenges.

Prior Work

VMood is adapted from an in-person Supported Self-Management (SSM) intervention originally developed in Canada.[22] SSM is grounded in principles of Cognitive Behavioural Therapy (CBT) and uses an SSM approach consisting of an Antidepressant Skills Workbook (ASW) and supportive

coaching delivered in-person by a non-specialist provider (e.g., community worker, peer navigator). SSM has been shown to be effective in the Vietnamese context through a previous randomized controlled trial (RCT; funded by Grand Challenges Canada [GCC]; 2016-2019) conducted by the research team across eight Vietnamese provinces.[23] In response to the Government of Vietnam's budgetary changes and the restrictions on in-person care imposed by the COVID-19 pandemic, the team accepted the request from the Vietnamese Ministry of Labour, Invalids and Social Affairs (MOLISA) to adapt SSM to a digital format, rather than scale-up the in-person SSM intervention as originally planned. This work is funded by the Canadian Institutes of Health Research and GCC (with match funding provided by MOLISA).

Ongoing Work

VMood, delivered via a smartphone app, is comprised of 3-months' engagement with the VMood program, which includes the various modules (e.g., introducing depression, antidepressant skills, reactivating your life) from the ASW being delivered in an interactive multiple choice format. Each module includes an introductory video with a text option. If there is inactivity for more than one week, reminders will be sent through push notifications. The VMood program also includes support delivered through the app via text messages by a social worker (SW). Social workers are a relatively new profession in Vietnam who work under the purview of MOLISA[24] and currently receive minimal mental health training. Participating SWs will be trained on basic depression, addressing stigma and providing coaching via the app through an online training program developed by the Institute of Population, Health and Development (PHAD). PHAD is a leading non-governmental research institute in Vietnam and the research team's implementing partner.

In Vietnam, responsibility for mental health is shared between MOLISA and the Ministry of Health (MOH). MOLISA oversees 24 long term care centres for individuals with severe mental health conditions attached to their Provincial Social Protection Centres (SPCs), while MOH oversees 36 psychiatric hospitals and 25 psychiatry departments within provincial general hospitals.[25] Despite a policy shift since 1998 towards a community-based approach to mental health care, with the focus on prevention and delivering low-barrier care to those with common mental disorders such as mild to moderate depression,[26–28] progress has been slow. Vietnam's mental health system is still comprised mainly of large tertiary hospitals providing care only for those with severe mental health conditions using predominantly pharmacological treatment, with very little to no community-based care available for those with mild to moderate depression.[29]

In this context, there is an added urgency to expand community-based mental health care for the large and growing population of those who need it. There is at present limited critical evidence on the unique considerations and practical guidance for the development and implementation of digital apps for depression adapted from evidence-based in-person formats. This paper will make a critical contribution by describing challenges encountered in the development, usability testing, and implementation of VMood in real-world settings in one province of Vietnam. At the time of writing, the larger RCT is being implemented across the eight participating provinces in Vietnam, informed by the findings described below. Findings also have applicability for the rapidly growing number of digital mental health interventions being developed for implementation in LMICs.

Methods

Overview

This feasibility study utilized mixed methods to examine the challenges influencing the development, usability testing, and implementation of the VMood digital depression intervention in Vietnam, and to describe strategies to mitigate the challenges employed by the research team. The team is comprised of researchers from diverse backgrounds (e.g., global mental health, anthropology, psychiatry, statistics, computer science) in Vietnam, Canada, and Australia. Three data components informed the findings (see Table 1). The overall timeframe for the feasibility study is from the beginning of app development (Jan 2021) to the end of the first phase of the RCT in one province in Vietnam (June 2024).

Table 1: Data Collection Components

Data	Description	Source(s)
Usability Testing	Early testing of the app to gather data on usability and acceptability. Conducted in Thanh Hoa province from Jun to Sep 2023.	Interviews and Focus Groups.
App Metrics	Data on rates of enrolment, login, and frequency and duration of engagement with specific components of the app to supplement qualitative usability testing results. Gathered from Thanh Hoa from Dec 2023 to Jun 2024	App usage data from the VMood app. ***Note:** due to technological challenges with VMood, app metrics data were not available from the usability testing and are instead reported from the first phase of the RCT, also conducted in Thanh Hoa. The RCT involves different regions; i.e., the participants are unique from those in the usability testing.
Discourse Data	Notes from various meetings and emails that describe the challenges in the development, usablity testing, and implementation of VMood, along with reports from the early phase of RCT implementation in Thanh Hoa.	- Meeting notes (monthly team, small group, internal); - Personal communications (emails); - Field trip report from first phase of RCT implementation in Thanh Hoa (Jan 2024); - Progress reports from Thanh Hoa RCT (Jan, Feb, Mar 2024).

Conceptual Framework

The feasibility study was informed by Proctor et al.,'s[30] Implementation Outcomes Framework, focusing on *acceptability*, *adoption*, *appropriateness*, and *feasibility* [see Table 2]. Additional outcomes: *costs*, *penetration*, and *sustainability* are beyond the scope of this study and the last outcome *fidelity* is captured in more detail as described elsewhere.[31] This framework evaluates implementation outcomes and are distinct from clinical outcomes examining effectiveness. However, they serve as intermediate outcomes to clinical outcomes because if an intervention is not implemented well, the intervention will not likely be clinically effective.[30]

Table 2: Proctor et al.,'s Outcomes for Implementation Research Framework[30]

Implementation outcome	Definition*
Acceptability	Perception among implementation stakeholders that a given treatment, service, practice, or innovation is agreeable, palatable, or satisfactory.
Adoption	Intention, initial decision, or action to try or employ an innovation or evidence-based practice.
Appropriateness	Perceived fit, relevance, or compatibility of the innovation or evidence based practice for a given practice setting.
Feasiblity	Extent to which a new treatment, or an innovation, can be successfully used or carried out within a given agency or setting.

*Definitions are taken directy from Proctor et al.,[30]

Procedures

Usability Testing

The usability testing component took place across six communes (municipal subdivisions) in one district of Thanh Hoa province. Names of the communes and district have been omitted for confidentiality purposes. The communes were selected in collaboration with MOLISA to represent diversity in terms of economic status (e.g., urban/rural) and population composition (e.g., elderly/young). Usability testing involved participants testing the VMood app, followed by the collection of qualitative data (interviews, focus groups). Project activities were conducted at the Thanh Hoa provincial SPC or in the community. See Table 3 for a summary of the participant categories.

Table 3: Overview of Participants from the Usability Testing

Category	Description	Source [Participant Code]
Policy stakeholder (n=1)	The Director of the provincial SPC. Responsible for providing oversight in project implementation in the province.	Interview [IPS-01]
Providers (n=15)	2 Social Workers (SWs) based in the SPC and responsible for project administration - 1 Project Coordinator responsible for all project activities - 1 Provincial Coordinator who served as the focal point for requests and recommendations from the province to the Project team). 13 Community Women's Union Staff (i.e., lay workers) based in the communes who are primarily volunteers active in their communities supporting social and health initiatives. Responsible for helping app users navigate the app.	Interviews [IPR-01 & 02] Focus Group [FGPR-01; n=8] Focus Group [FGPR-02; n=5]
App users (n=6)	With depression caseness, as measured by a Patient Health Questionnaire-9 (PHQ-9*[32]) score >=5.	Interviews [IAU-01 to 06]
Clinical Experts (n=5)	Familiar with CBT principles and depression. 2 from Vietnam, 3 from Canada.	Interviews [IEX-01 to 05]

*The PHQ-9 is a widely used short depression screening measure that has been validated with digital studies.[33]

The policy stakeholder, along with the two SWs based at the Thanh Hoa SPC, were recruited through official Government channels. The community women's union staff (lay workers active in their communities; n=13) based in the communes, were recruited by the Thanh Hoa Project Coordinator to support app deployment. PHAD team members provided the training program to the providers in person. App users who self-identified as experiencing symptoms of depression were recruited from the community through the six local Commune Health Centres (CHC). They were recruited through community engagement meetings held by the PHAD team and recruitment flyers posted at the CHCs. Staff at the CHCs, trained by PHAD staff on study objectives, helped to facilitate recruitment. Recruitment began in May 2023 and took place over a one-month period. A total of 642 app users were recruited and invited to download VMood and complete the registration and consent forms embedded within the app. Once app users provided consent, they were asked to complete the

embedded PHQ-9, the nine-item depression screening measure.[34] Only participants identified with depression caseness as measured by a PHQ-9 score >=5 (n=154) were invited to participate. Community women's union staff assisted app users with app download and registration. Clinical experts familiar with CBT principles were recruited from Thanh Hoa, Vietnam (n=2) and British Columbia, Canada (n=3). Experts in Vietnam were recruited through Thanh Hoa's SPC, with the recruitment process coordinated by PHAD. Experts in Canada were recruited from a local community-based counselling and support services organization along with an expert who was familiar with the in-person SSM intervention. All clinical experts from Canada were native Vietnamese speakers. The recruitment process for all participants in Vietnam was supported by the national MOLISA Coordinator based in Hanoi who has been involved in recruitment throughout the research program (2013-present).

Usability testing involved all participants downloading and testing the app. App users were notified they had the option of connecting with a commune SW through a messaging function built into the app for any questions regarding app navigation and basic inquiries about depression. Formative literature on sample sizes for usability testing studies indicate that a sample of 5 participants can identify 80% of a system's usability issues, that additional participants will reveal fewer and less novel usability issues, and the most severe usability issues are likely to have been captured in the first few participants.[35]

Exit interviews were conducted with the policy stakeholder and the two SWs, and focus groups were conducted with the 13 community women's union staff members to obtain their feedback on app usability. Focus groups are helpful for elucidating additional information on issues of interest due to interactions and group dynamics between multiple users[36] and can help to generate a richer understanding of participants' experiences and views[36,37], in addition to being time-efficient. Interviews were also conducted with a convenience sample of the 154 app users with depression caseness involved in VMood testing (n=6), based on their availability, to gather feedback on their experience using the app. Questions explored implementation outcomes acceptability, appropriateness, adoption, and feasibility. Lastly, interviews were conducted with the clinical experts to provide feedback on the conceptual components of the intervention adaptation along with any strengths and suggestions for improvement.

All interviews and focus groups were conducted in-person by first author (LC), with an interpreter assisting in Vietnam. Interviews lasted between 30-60 minutes and the focus group discussions lasted between 65-75 minutes. Interviews and focus groups were recorded, transcribed, and translated to English using forward and backward translation. Detailed field notes during and after the interviews and focus groups were recorded to capture thoughts and observations about the interactions that could help inform the data analysis process.[36]

The policy stakeholder and providers were given an honorarium the equivalent of CAD$10 (approx. VND185,000) for participating in an interview or focus group. App users were provided with CAD$20 (VND370,000) for their testing of the app, along with a phone credit of CAD$3 (VND56,000) for data usage on their mobile phones to access to app. Individuals who participated in the interview were provided an additional CAD$5 (VND9500). Lastly, clinical experts in Vietnam received an honorarium of CAD$50 (VND925,000) for their participation, including the interview. Clinical experts in Canada received CAD $150 (VND2,775,000). The difference in honoraria between experts in Vietnam and Canada was due to differences in salaries of mental health experts and living costs between the two countries, and because the Ethics Committees in Vietnam would not allow for incentives outside their range.

App Metrics

Due to technological challenges and the way the beta version of the app was designed (reported below in results), app usage data were not able to be collected from the participants in the usability testing and are thus not reported in this paper. Instead, app usage data from the first phase of the RCT, also conducted in Thanh Hoa province but in a different district, are included. Recruitment in the first two communes from the first RCT district in Thanh Hoa began in Dec 2023 and was completed in Mar 2024. App usage data are incorporated from these two communes and include data on duration of engagement with the VMood app from 20 app users, all of whom have completed the 3-month VMood program as of Jun 2024. Data using built-in analytics includes metrics for evidence on implementation outcome *adoption*.

Discourse Data

The feasibility study also involved an examination of discourse data (meeting minutes, emails, progress reports) around the app development process that took place from Jan 2021 to Jun 2023, along with usability testing in Thanh Hoa from Jun to Sep 2023 and implemention of VMood in the first phase of the RCT in Thanh Hoa from Dec 2023 to Jun 2024. The various discussions examined the challenges encountered throughout the various phases of the projects and also centred around brainstorming strategies to help ensure continued implementation and success. Certain small group meetings focused on specific aspects of the app development (e.g., technical challenges) or implementation processes (e.g., screening concerns) as they arose with select members of the team with relevant expertise.

A main source of data for the app development discussion was the in-person team meetings in Hanoi, Vietnam (Aug 22-25, 2022). Most members of the geographically distributed research team (from Vietnam, Canada, and Australia) attended. The workshop focused on the app development process, including examining the associated challenges the team encountered from initial development of the app to subsequent revisions and strategies to help address some of those challenges. All discourse data were either transcribed or captured through detailed meeting minutes and translated where applicable.

Monthly reports on the progress of the first phase of RCT in Thanh Hoa (n=4) were prepared by PHAD, the implementing partner in Vietnam, detailing implementation updates as well as the challenges encountered and proposed solutions. Challenges included those the team had experienced in addition to challenges discussed with the provincial implementing partners in Thanh Hoa, who shared their experiences in the community when promoting and implementing VMood. Detailed field notes were also documented throughout the study period by LC to summarize and interpret the various discourse data.

Data Analysis

Qualitative interview, focus group, and discourse data were analyzed using thematic analysis as outlined by Braun & Clarke[38] to identify and analyze common themes across transcripts that capture important meanings and patterns in the data. Thematic analysis is the most commonly used analysis method in qualitative research.[39] A coding framework was developed deductively and separately for the fidelity and usability testing, informed by the fidelity-adaptation analytical framework and the outcomes for implementation research framework, respectively,[40] and also inductively through analysis of the qualitative data. In addition, analysis of focus group data took into account the group dynamics, captured via the focus group discussions themselves and researcher field notes. Coding

was a multi-stage process that involved open coding, where preliminary summary statements were provided for elements discussed in the transcript and form an initial coding framework and gathering all statements from open coding to collapse into main categories and subsequently into themes, along with validation of the coding by another research team member (senior author JON) in the form of reviewing independently a percentage of the transcripts.[39]

App usage data were analyzed using basic descriptive statistics.

Data triangulation and reflexivity were used to help ensure the trustworthiness of the data analysis and research findings.[41] Triangulation was used to explore congruence and divergence between data sources, thus increasing the rigor of the findings and reflexivity, aided by the detailed field notes and memos made during the qualitative coding process, to ensure trustworthiness of the research findings.[42] These strategies provide an audit trail of the analytic process to ensure that other researchers can arrive at a comparable conclusion following the same processes.[43] The audit trail also includes detailed records of the study's methods and procedures. NVivo 14 software[44] was used for all qualitative analysis.

All procedures were approved by the Research Ethics BC Board in Canada [H21-02938] and the Institutional Review Board at PHAD in Vietnam [PHAD-2022/VMOOD-01].

Results

Findings from the feasibility study demonstrated there were seven main challenges that fall within Proctor et al.,'s 4[30] Implementation Outcomes Framework. See Table 4 for a summary.

Table 4. Summary of Themes

Acceptability
1. Challenges with recruitment and uptake of the app
Adoption
2. Challenges with utilization and engagement
Appropriateness
3. Screening challenges
4. Digital divide
5. Limitations to digital applications for mental health
Feasibility
6. Technological challenges
7. Funding and policy constraints

Acceptability

Challenges with recruitment and uptake of the app

The first challenge reported was around the uptake of the app as social workers and others from the SPC shared that many participants were reluctant to download the VMood app and to participate. Reasons cited included resistance to more apps and new technology and security concerns. The policy stakeholder reported that, "People are exposed to an abundance of apps; therefore, it is difficult to keep users engaged and accessing the app frequently if there is nothing of interest inside it" and further, "people in Thanh Hoa […] are reluctant to install unfamiliar apps on their phones out

of fear of viruses and malware," (IPS-01) which was another factor impacting participants' willingness to download and engage with the app. A provider shared that that "some people are afraid and worried about their information being leaked." (FGSW-02) From the perspective of app users, they added that "I don't use others [software/apps] since I don't find them useful or practical." (IAU-01) Therefore, "the first challenge in terms of getting people to try out this app is to encourage them to download and install a completely new app." (IPS-01)

In addition, the policy stakeholder shared that many individuals interested in the usability testing were not able to participate because their mental health was good according to the PHQ-9 measure and were thus ineligible. Many of the individuals were reruited through community events and were friends and relatives of the various village networks and associations and were quite active in their community and thus less likely to have depression. A solution employed by the team to address this was the shift to recruiting using a list of high-risk individuals generated by the communes. As a provider suggested, "Instead, we could target specifically those who have recently experienced a traumatic event, such as the demise of a family member; then, the likelihood of them experiencing symptoms of depression will be much higher. By doing so, we would be able to reach a group in need of our services and support much more efficiently than if we were to search and look for 1,000 random individuals." (ISW-01) A team member also suggested having team members deliver instructions to individuals who have depression symptoms and conduct screening in their homes as those with depression typically do not leave their homes and attend the community events. Another provider suggested "we must consider the commune people's committee (the administrative centre for government in the commune) and the medical center, as they are frequently packed with people and have a high likelihood of having someone in need of our services or projects." (ISW-02)

Solutions to address these recruitment and uptake challenges centered around using promotional efforts to increase the legitimacy of VMood and awareness of its benefits "to get more people interested in [the] app." (IAU-03) As another app user stated,

> "we must demonstrate the superior features of the app, particularly the application's features and functionality, so that people understand that using the app is advantageous for them and, as a result, more people are inclined to use it voluntarily." (IAU-04)

A social worker reported, "the communication activity to promote this model is quite limited, so sometimes only people in the Project's region have heard of it, and not many others are aware of it." (ISW-02) An app user mentioned, " in order for this software to reach a wider audience, communication and propaganda processes for people must be emphasized.… When they understand how to use the app and enjoy using it, they will tell others, and ultimately, everyone will start using it." (IAU-06) Strategies included pushing more information and education through Zalo (Vietnam's messaging platform) and Facebook group chats of the commune's various unions (e.g., women's, youth, pregnant women) and by combining with promotional strategies for other initiatives. The team has also created a series of promotional broadcast messages to be sent via Zalo and Facebook groups to help address concerns from the community about scams and phishing.

In addition to promotional efforts distributed by the team and communes, participants spoke to the importance of increasing the visibility of government support to encourage trust and uptake, especially in the context of increased scams orchestrated through digital media such as smartphones. For example, a provider indicated: "I think it [VMood] should have a QR code or an official, legal advertisement for this app; and the site where we place promotion signs or posters, or where we help users in installing this software, should be a government-related and trustworthy location, such as a medical station. [Otherwise,] people might think it's a scam." (FGSW-01) An app user echoed this, stating, "people today frequently have faith in initiatives that receive support from the Authority. So

if it is protected by the government, people will certainly follow and try it out." (IAU-04). There was a recommendation from the provincial Social Protection Centre for MOLISA to dispatch notification to the provinces to clarify the information on VMood and to increase trust in the app. Another provider shared their perspectives from a different angle:

> "As a professional, I have no right to impose social issues (such as forcing them to install the app) on people. However, if we promote the use and installation of this app through and with the assistance of the government, local authorities, and the district or commune-level government, then participation will undoubtedly increase." (FGSW-02)

Another challenge to recruitment was around low mental health awareness and stigma. SPC staff reported that commune health staff were at times introducing the project using words that held sensitivity in the community, such as mental illness, which people still associate with schizophrenia. Consequently, some individuals in the community were afraid of being discriminated against and were therefore reluctant to participate in the project. To help address this, the PHAD team has prepared an introduction sheet for the local commun health staff for them to refer to when recruiting participants.

Promisingly, participants in all three groups from the usability testing spoke to the convenience and general acceptability of VMood in their communities, indicating it was simple, easy to use, and suitable for all ages. Once individuals install the app, "from then, people will then begin using and recognizing the app's utility and usefulness." (IPS-01) Importantly, a number of the participants indicated that the app "is appropriate for persons suffering from mild depression," (IEX-02) which is what the app, along with the original in-person intervention, was designed for.

Adoption

Challenges with utilization and engagement

Findings from the qualitative interviews and focus groups indicated that app user engagement was fairly low. The first factor influencing participant's adoption of VMood was the busy schedules of the app users. While they reported enjoying the app and certain features, including the "multiple-choice questions" and videos, one app user indicated, "I haven't watched all of the videos because I do not have sufficient time to watch them all." (FGSW-02) Another participant similarly reported, "I was able to use the app perhaps 2-3 times [in a month]. It's not that often because I don't have a lot of time due to my workload." A provider mentioned people working in agriculture may not find the app as acceptable as perhaps a younger participant because of their busy schedules during "agricultural seasons," where "people will be preoccupied with work or study," which may result in "an overall drop in their interest in mental health." (ISW-01)

Strategies to increase participant engagement included incentives, such as "monetary support," (FGSW-01) in the form of a phone card or as another provider from the same focus group mentioned, "a form of award that could be turned into cash every time a user correctly answers a question." This provider recognized that "the project won't be able to offer monetary assistance endlessly," but perhaps "could opt to keep it simple, such as 10 points = 10,000 VND (CAD $0.50)." They concluded that "this would very certainly encourage users to open the app and use it more frequently." Another strategy was suggested by PHAD, informing participants that they would be entered into a draw for an Android smartphone. These strategies are being implemented in the RCT.

Another strategy suggested was “a management team, or group leader” who “should be assigned to each locality. They could be in charge of contacting or reminding people [from that area] through this app.” (FGSW-01) They clarified that “an administrator account must be created for the medical station so that they can administrate their patients” and “keep track of them.” Another provider from the first focus group spoke to this need, indicating that in their commune there was “a large number of people who have installed this app; nevertheless, the management provided to manage and follow up with this group is insufficient.” (FGSW-01)

App usage data from the early phase of the Thanh Hoa RCT implementation showed that more than half of the app user participants (n=12; 60%) demonstrated high levels of engagement with the app (>120 minutes), 6 (30%) demonstrated moderate levels of engagement, and only two participants (10%) engaged with the app for less than 60 minutes since enrolment. See Table 5 for an overview of app usage time. Note that usage for app users is tracked beyond the 3-month intervention period for an additional 3-month follow-up period (total of 6 months). These data, which were last extracted on June 24th, 2024 showed that since enrollment, the 20 app user participants engaged with the app on average for 145.9 minutes (SD = 96.2), with the highest engagement being 366 minutes and lowest 13 minutes (range 353; median 125.5). These findings suggest that some of the strategies to increase participant engagement may have been effective. In general, the literature indicates the ideal dose of engagement for digital health interventions is still unclear, and effective engagement, rather than the quantity of engagement, may be more important for behaviour change.[45] For the purpose of this paper, the engagement cut-offs were established based on preliminary interviews exploring app engagement with app users in the RCT from two provinces and the clinically significant treatment dose will be investigated further in the RCT.

Table 5. App Usage Time

		Time usage (cumulative minutes) by Date of Data Export (MM-DD)													
User	**Enrolled on**	**06-24**	**06-19**	**06-12**	**06-05**	**05-29**	**05-22**	**05-15**	**04-24**	**04-17**	**04-10**	**04-03**	**03-29**	**03-22**	**03-14**
1	2024-03-21	62	47	6	6	6	6	6	5	4	4	4	4	4	n/a
2	2024-03-21	123	10	10	10	10	9	9	5	2	2	2	2	2	n/a
3	2024-03-21	147	147	21	3	3	2	2	2	1	1	1	1	1	n/a
4	2024-03-20	164	105	17	17	8	7	7	5	5	5	5	5	5	n/a
5	2024-03-20	338	50	10	10	10	10	10	9	4	4	4	4	4	n/a
6	2024-03-20	204	133	87	5	5	4	4	3	1	1	1	1	1	n/a
7	2024-03-18	128	124	6	6	6	5	5	3	3	3	3	3	3	n/a
8	2024-03-18	84	7	7	7	7	7	7	5	5	5	5	5	5	n/a
9	2024-03-18	62	62	61	13	13	12	12	11	10	10	10	10	10	n/a
10	2024-03-15	310	95	6	6	6	6	6	4	4	4	4	4	4	n/a
11	2024-03-14	150	119	38	38	38	19	19	17	14	14	14	14	14	0
12	2024-03-04	13	13	13	13	6	6	3	2	2	2	2	2	2	2
13	2024-03-04	85	40	40	5	5	5	5	2	2	2	1	1	1	0
14	2024-02-28	366	97	60	56	36	36	32	30	30	30	30	30	23	22
15	2024-02-26	164	156	137	67	32	24	13	9	9	7	7	7	5	5
16	2024-01-19	86	79	79	22	21	21	21	18	18	18	18	18	18	5
17	2024-01-18	46	46	46	9	9	9	9	6	6	6	6	4	4	4
18	2024-01-18	82	82	82	26	25	24	24	21	18	18	18	18	18	15
19	2023-12-31	123	116	101	67	46	44	44	21	21	21	21	21	20	20
20	2023-12-27	181	170	144	75	59	59	48	45	43	5	5	5	5	4

Appropriateness

Screening challenges

The first challenge reported that relates to VMood's appropriateness was around screening. Thanh Hoa SPC participants reported that some individuals responded falsely to the embedded PHQ-9 screening measure to gain access to the app. Certain app users who were invited to the usability testing initially scored low on the PHQ-9 and per the study protocol, were asked to retake PHQ-9 in two weeks. Some participants then asked for and received instructions from the commune health staff on how to get access to the app by scoring high on the PHQ-9. Thus, many participants in the usability testing with depression as measured by a PHQ-9 score >=5 (n=154) did not in fact have depression. Commune health staff confirmed the six app users who participated in the interviews were true positives. This screening challenge was discussed at team meetings and it was decided that the full version of the app would be provided to all app users, regardless of depression caseness, so there would be no cause for faking their PHQ-9 scores. Another suggestion was made to communicate clearly to the communes on the intervention benefits for those who need it.

Digital divide

Another challenge that impacted VMood's appropriateness is the digital divide. Although most participants commented on the strengths of the VMood digital intervention in reaching a broader population, there were concerns raised around the digital divide – namely, how certain populations may get left behind. For example, a clinical expert shared:

> "I can see the app can be very applicable to my generation who are quite familiar with using apps and internet to navigate life situations. But for my parents' generation, for example, using this app can prompt a lot of anxiety for them to be logged in and where are the buttons and all that." (IEX-05)

Similarly, an app user stated that "senior citizens […] have a more difficult time processing than young people like me." (IAU-03) Another app user also commented on their parents, who "are not proficient with technology" and may not be able to login and "use this app on their own." This was similar to the in-person RCT, where elderly individuals had difficulty reading the ASW and asked their family members to help read to them. Despite this, this app user indicated they would introduce the VMood app "if any family members needed it."

Other participants also commented on structural barriers to widespread implementation and uptake of VMood. One provider reported, "As urbanization expands to the countryside, a group of young people might be affected from the use of the Internet." (FGSW-01) Another provider reported the same concern around internet connectivity issues, "In some locations, the connection or wifi signals are inadequate or unstable, which could have an effect on the implementation of this project." (ISW-01) Howevever, it was reported by the Thanh Hoa leadership that Wi-Fi is available in most homes because television typically runs on internet, in parallel with Wi-Fi. And similarly 4G is available in most homes except for some older generations. In addition, the project provides app users with a phone credit for their participation.

The team discovered that a larger number of individuals than anticipated did not own newer smartphones. An app user mentioned "while technology coverage in Vietnam is high, the proportion

of the population owning smart devices is limited." (IAU-06) As a result, they "rarely have the opportunity to interact with (VMood)." (IEX-05) A clinical expert shared that "farmers, for example, do not know how to use smartphones and do not even own them […] if you move further away from the city, then you would see that not everyone knows how to use them." Another instance of lack of smartphone ownership was given by a provider, who explained that "it can be difficult to install the app if a family has 2-3 members who are depressed, but only one of them has a smartphone." (FGSW-02) The decision made after discussing with the SPC staff and staff at the local communes was to recruit only those with smartphones for the RCT as it would not be feasible to provide smartphones to all app user participants.

Lastly, the team also learned during the usability testing that VMood did not always function properly on older smartphones that were not able to support newer apps. After discussing with the app development company, they confirmed that this limitation is due to Apple and Android providers who do not support newer software and will mean that VMood will likely be available only to users of newer smartphones.

Limitations to digital applications for mental health

Another challenge influencing VMood's appropriateness was limitations to digital applications for mental health. These included the complexity of the app, such as the CBT principles VMood is based on, along with cultural and linguistic challenges. The first point participants spoke to was the complexity of the app. Though one provider from the first focus group indicated that "In my opinion, the installation process is relatively easy and convenient for most people," (FGSW-01) another provider from the focus group who indicated they are a "collaborator [community women's union staff] who provides advice to people […] making it easier for them to access the app" stated, "The initial installation phase is easy and convenient for people to follow, but because this app is quite new, the app has not yet reached a high level of usage. Therefore, I believe that this initiative still requires collaborators to assist users in the process of using this app to evaluate their health." (FGSW-01)

From the perspective of app users, they similarly mentioned that "It might be difficult if I let myself figure it out because it isn't written on the software about what to do or why. How can I accomplish it if I don't know what it is?" (IAU-05) App users also spoke to the complexity of the VMood content. For example, one app user indicated that while they enjoyed watching the videos in the app, "the explanation for the app's content is a concern. I'm not sure if it's because of my age or my academic level, but there are several things in the app that I have trouble understanding." (IAU-02) Suggestions were provided by participants to help reduce some of these concerns. A clinical expert proposed the creation of "a group of the people who are using the app and having a little talking circle […] empowering each other." (IEX-04) In addition, team members discussed and agreed to increase communication between the project team and communes to provide clearer guidance on app usage, such as encouraging app users to review the embedded instructional videos accompanying each skill component in detail and to contact their social worker if they had any app-related questions.

Cultural and linguistic challenges and suggestions

VMood was adapted from an in-person SSM intervention that was originally developed in Canada. In the previous RCT, where the team demonstrated its effectiveness in the Vietnamese context, the ASW and overall approach had been tailored to fit the local context. Despite this, participants shared feedback to include more culturally appropriate examples for app components such as reactivating your life, the food guide, sleep environment (e.g., "including traditional local remedies for sleep"

[IEX-03]) to improve VMood's cultural appropriateness. One clinical expert mentioned that the app is focused more on the "brain", but "Vietnamese people, they can be superstitious." (IEX-04) Another participant remarked that, "a few questions only apply to a specific group of workers such as office workers, whereas lots of Vietnamese are freelance or manual labor.[…] The context of the question should be relevant and close to a normal daily life of a Vietnamese." (FGSW-01)

Another provider from the focus group suggested that "the next training session at the center should be tailored to suit the local area." (FGSW-01) This was noted as being especially important considering many of the participating districts in Thanh Hoa province are "mostly in rural areas." Lastly, a provider spoke to the implementation and scale-up challenges posed by cultural and linguistic issues:

> "I imagine that each region will face distinct difficulties, such as mountainous regions and remote islands. Because we are discussing a nationwide implementation of this app, each region will face particular difficulties. For instance, it might be challenging to introduce a Kinh-language app in areas where people speak ethnic languages. These are the difficulties I could imagine if we were to deploy this application nationwide." (ISW-01)

The team reviewed the suggestions and Vietnamese-speaking members of the team, consulting with a social worker living in a rural community, added more culturally relevant examples for the realistic thinking and problem-solving skills components to increase appropriateness. Promoting VMood acceptability and usability requires an understanding of and tailoring to local traditions and culture, which participants indicated will be a key factor to its sustainability across Vietnam's diverse communities, each with their unique needs.

Feasibility

Technological challenges

Technological challenges included delays experienced with the app development process and missing app usage data from the usability testing. The team wished to ensure VMood had theoretical fidelity to the original in-person intervention and also practical fidelity in terms of usability in its digital format. See Chau et al.,[31] for results from the fidelity testing. As a result of this, the development process was long and required frequent exchanges between the larger project team, our implementing partners in Vietnam who were working directly with the app development company, and the app development company. Any edits made to the app also required approval from the Apple App Store, which further delayed the process. Developing the app was a major undertaking that required significant input and resources.

Some participants from the usability testing indicated that the text size was a bit small, especially for the elderly, and suggested increasing the font size. The team discussed with the app development company and agreed to delay this change until after the RCT is launched in Thanh Hoa as making this update would require weeks and further, with an increase in font size the text may flow out of the frame on smartphones. Another issue experienced during the usability testing was that the instructional videos lagged in some areas with slower internet speed. To help mitigate this, Youtube was chosen as the video hosting platform as it can adjust the video stream quality based on the user's internet connection.

Another technological challenge encountered was with the technical complications in the original

app design. It did not have the functionality for capturing app usage data, including the number of logins. We were under some pressure from the Government of Vietnam to launch VMood fairly quickly in order to meet their fiscal timelines and the app design company had not yet set up the app to capture usage frequency and duration. We were made aware of this after usability testing had been completed and were thus not able to include any app usage data from the usability testing participants. The app was subsequently updated to include built-in metrics to capture usage data such as frequency and duration of engagement with the various skill components.

Funding and policy constraints

Funding and policy constraints are the last challenge the team encountered. These include a limited budget and resources for social worker support. Social workers participating in the larger RCT will provide support as part of their regular job responsibilities, which typically involves a heavy workload. Their time will thus be limited for both training and project implementation. Therefore, the training they receive on project objectives, app components, and basic depression needs to be basic and efficient to ensure accessibility and practicality. Some social workers commented on limitations to the training program:

> "Regarding in-depth training or how to deliver counseling for a case of depression, we have not received such training. We have not received specialized training on depression; we have only received training related to the book, including how to use the book/handouts and how to assist others in using/reading this book.[…] I am interested in attending other in-depth training sessions on this topic if they are offered." (ISW-02)

Despite this, social workers indicated they were satisfied overall and appreciative of the training and mentioned that prior to receiving the training provided by project team members on how to administer the app and on basic depression, they had previously received little or no training on depression. For example, one provider stated, "I thought the training session was very sociable and enjoyable, and I learned some new things [about depression] that I had never known before." (FGSW-01) Another provider also reported that the training program is "quite handy. I was able to gain extra knowledge and also use what I learned in these sessions for my everyday tasks." (IPS-01) Further, for VMood installation and navigation, which is mainly the role SWs have on this project, a provider shared that "If we are only discussing whether the training is sufficient to allow us to assist users with accessing and using the application, then I believe the training materials are adequate." (IPS-01) Other social workers also shared that they had limited capacity to provide extensive support through the app. The app is not meant to be a magic bullet for everything but is intended as a widely accessible tool for those with mild to moderate depression, with minimal support on app navigation and basic depression provided by social workers.

Social workers are very busy and at the commune level, many are not adequately compensated and operate on a volunteer basis. Three out of the six communes that participated in the usability testing had changes to the social workers involved in our project. High turnover posed a challenge for the feasibility testing slowing down implementation in the early phase of the RCT in Thanh Hoa as there was a need to train new social workers fairly frequently, but the team has developed clear training guidelines supporting the online training program and provincial project managers will be responsible for training new personnel carefully according to the guidelines. In addition, the Director of Thanh Hoa's SPC also changed just prior to the expected launch of the RCT, which also contributed to a delayed RCT launch in Thanh Hoa.

Despite the challenges described above, ultimately most participants indicated that the VMood app is an important tool that can assist individuals in the community experiencing depression. Strengths

reported for the digital intervention included being able to use the app privately “at home,” (IEX-01) in their own environment, potentially mitigating some of the effects of stigma. As one clinical expert stated, “It's great because depressed patients frequently don't want to tell anyone about their problems, but they can download this app, watch it, understand it for themselves, and change their mindset.” (IEX-02) In addition to being able to use VMood in the comfort of their environment and at their convenience, VMood is also able to “reach a broader audience.” (FGSW-01)

A provider who had been involved with the RCT for the in-person intervention compared it with the digital version and shared that with the previous intervention:

> “Since the release of the VMOOD software, I've realized that it's much better in terms of security. Because previously we had to send social workers to people's homes to ask questions, we no longer need to do so, and users can now experience this software on their own. This will reduce the likelihood of people being shy while answering the PHQ9 questionnaire, which could contribute to inaccuracy. […] In the past, when we went to collect people's responses, they sometimes responded differently despite their obvious illness behavior.” (ISW-02)

In summary, participants expressed unanimous support for the VMood intervention and highlighted the need for increased community-based mental health care because currently “there is no infrastructure in Thanh Hoa to support these people.” (ISW-01) This provider reported that “Because in today's developed, modern society, life and work are fraught with pressures and difficulties. Consequently, I believe that numerous people are struggling with their mental health. I believe that many people will be interested in this topic.” A clinical expert also recognized the limitations to the current mental health system and shared that they hoped the intervention would be scaled-up to assist more people to “relieve some of the burden on [them].” (IEX-01) The Government of Vietnam recognizes the gaps in community-based mental health care and has provided ongoing support, including commitment in the form of match funds, to support VMood implementation and scale-up.

Discussion

Principal Results

Feasibility testing of the VMood app demonstrated a number of key challenges to its development and implementation that fell within Proctor et al.’s[30] four implementation outcomes: acceptability, adoption, appropriateness, and feasibility. Recruitment challenges arose that impacted VMood’s *acceptability*; app utilization and engagement challenges impacted its *adoption* in the community; screening challenges along with considerations around a digital divide and limitations to digital applications for mental health impacted VMood’s *appropriateness*; and lastly, technological challenges and funding and policy constraints needed to be considered to ensure VMood *feasibility* within the Vietnamese context. Extensive discussions at various meetings throughout the app development process, usability testing, and the launch of the RCT in Thanh Hoa, among team members and with leadership at the Thanh Hoa SPC helped the team to fully understand the challenges and brainstorm timely solutions to help mitigate them.

Participants found VMood to in general have acceptability within the Vietnamese context, although there were extensive challenges reported with recruitment, such as resistance to more apps and new technology, security concerns, and persisting low mental health awareness and stigma. Similarly, other studies have shown that data privacy and security are concerns that impact acceptability.[46]

Mental illness stigma is high in Vietnam as in many other Asian countries[47] but promisingly, depression app usage has been shown to increase mental health literacy and awareness and to mitigate the effects of stigma [48] as people are able to access them in their own environment and experience increased anonymity.[49] A main solution to enhance acceptability and legitimacy of VMood was to increase promotional efforts, including pushing more information and education through social media and incorporating more government support on promotional materials. Usability testing also highlighted the importance of a targeted recruitment approach using lists prepared by Commune health staff of individuals considered to be at a higher risk of developing depression based on recent adverse life changes. This strategy appears to have been effective in the first phase of the RCT. Participants also reported on some challenges to adoption, including the busy schedule of app users which may prevent them from fully engaging with the app, especially during busy periods, such as harvesting season. Incentives in the form of money and a chance to win an Android smartphone were incorporated for the RCT to encourage participant engagement. Lastly, the specific symptoms of depression such as low motivation, concentration difficulties, and behavioural avoidance may pose additional challenges to app engagement.[17] For example, Arean et al., (ref) found that participants with a higher baseline depression score (measured using the PHQ-9) accessed their two depression apps less frequently, suggesting that depression apps may have the greatest impact on individuals with milder levels of depression.[50] Screening through depression apps could help to provide an indicator for those who require, and should be prioritized, for more in-person treatment. App usage metrics from the early phase of the Thanh Hoa RCT indicate that 60% of the participants had high engagement with VMood (>120 minutes), 30% had moderate engagement (60-120 minutes), and 10% had low engagement (<60 minutes). A closer examination between app user engagement and their PHQ-9 scores is warranted and will be conducted in the larger RCT.

Appropriateness of VMood was impacted by screening challenges where a number of participants responded falsely to questions in the embedded PHQ-9 in order to gain access to VMood. There are also considerations that need to be made for certain groups (e.g., those who are elderly) to ensure equitable access for all who might benefit and to not further increase the digital divide, which is “a division between people who have access to and use of digital media and those who do not”.[51,52] The last challenge impacting appropriateness was limitations to digital applications for mental health. Lower income countries have experienced faster mobile phone growth rates compared to higher income countries.[48] For example, Vietnam, a country of about 100 million people has about 140 million mobile-cellular telephone subscriptions.[53] Despite this, it was found that many individuals in the communities did not in fact own smartphones, or owned older versions that were not able to support newer apps. In addition, for a tool that is meant to be widely available accessible and available, there were issues reported on the complexity of the app, including the CBT principles, and cultural and linguistic concerns. These were addressed respectively by encouraging participants to review instructional videos thoroughly and incorporating more culturally relevant examples. The structured approach of CBT translates well to being adapted to a mobile format [54] and with the accompanying videos and any necessary support provided by a social worker, community leaders were confident on VMood’s appropriateness. Cultural appropriateness is a key consideration when adapting an intervention from one context to another. See Chau et al.,[31] for an in-depth discussion on cultural fidelity. There is a growing understanding of and attention to ensuring culturally-appropriate mental health care for people in diverse settings.[55] Despite some of the challenges reported on the complexity of the app, participants did not comment on some of the more common hurdles to usability found in the literature such as the tool requiring too much time to enter data or being irrelevant to their needs.[56]

As discussed, a main challenge encountered in this study was related to technological issues resulting in missing app usage data from the usability testing. Despite this, through interviews and focus

groups usability testing participants were unanimous in expressing their support for the app and provided positive feedback for various components of the app, such as the instructional videos and realistic thinking skills. Interviews and focus groups are two of the most commonly used methods for usability testing, in addition to questionnaires and usage data, and allow for the elucidation of users' experiences and the likeability of the app in addition to barriers to use and ideas for improvement.[57] App users also indicated that they would recommend VMood to friends and family based on their experiences up to the date of their interviews. In addition to qualitative reports from the usability testing participants, app metrics from the first phase of the RCT launch in Thanh Hoa complemented the results and showed that 60% of the app users demonstrated high engagement with the app (>120 minutes), suggesting that they found the app to be helpful for their needs.

In relation to feasibility of VMood implementation, participants also commented on the importance of having support from social workers through the app and corresponding social worker training to ensure they are adequately prepared to provide basic support through the app. A systematic review examining the effects of mobile apps on stress, anxiety, and depression similarly found that integrating human support into digital health interventions has been shown to increase usability[58] and larger clinical effects than standalone apps.[59] Participants spoke to the importance of social worker support, but also recognized the need for a training program that can facilitate rapid deployment of social workers and agreed that a balance needs to be made between feasibility and appropriateness within current budgetary and policy constraints. It is important to recognize the concurrent responsibilities of social workers, who were participating in this project as part of their regular work duties, and to avoid overburdening them, which in turn can contribute to high stress and high turnover.

Presently, evidence on the effectiveness and cost-effectiveness of smartphone-based apps is fairly limited,[49,60] with at most only about 4% being evidence-based.[61] There is also limited evidence on whether effectiveness studies were impacted by failed implementation.[62] Implementation science focuses on practical approaches to enhance the scale-up and sustainability of various evidence-based interventions[63] by helping to bridge the longstanding knowledge-practice, or know-do gap.[64] The various challenges reported during VMood development and implementation, along with solutions to address them will be critical as the research team conducts the RCT across the remaining seven provinces (this work is ongoing) to help avoid similar challenges. Suggestions from the usability testing participants, leadership in the communities, and the research team may help mitigate the high dropout rates and low engagement with technologies that are increasingly recognized as challenges for digital health interventions, both in terms of RCT validity and sustained engagement.[56] Findings from this feasibility study will also contribute important evidence informing other research examining the development and implementation of similar digital interventions for mental health. However, it is important to recognize that certain strategies to increase recruitment and engagement, such as providing app users with a phone credit for their participation and entering them into a draw for an Android smartphone, were necessary and suitable for the RCT but may not be feasible for scale-up. Thus, should the RCT demonstrate VMood's effectiveness, other strategies supporting real-world implementation beyond the context of an RCT will be required for its scale-up. Ultimately, despite these challenges and limitations, participants from the usability testing spoke unanimously to the importance of a low-cost and accessible intervention like VMood that could help fill a growing treatment gap in the community, where mental health conditions are prominent and on the rise, especially within the context of the COVID-19 pandemic.[3]

Conclusions

Adjustments based on recommendations criticial to VMood's usability were made to the app that is

currently being tested in the RCT across eight provinces of Vietnam. The RCT will examine VMood's effectiveness along with cost-effectiveness. See Chau et al.,[65] for the RCT protocol. The Government of Vietnam has provided ongoing support to this program of research as part of a strong and sustained research-policy collaboration since 2013 (see Murphy et al.,[66] for further details) and has committed to scale-up in the other Vietnamese provinces should results demonstrate effectiveness. Findings from this implementation science feasibility study contribute important evidence on the challenges to the development and implementation of a digital depression app adapted from an in-person intervention in an RCT in Vietnam, an LMIC. Findings also have applicability for others looking to develop and implement digital interventions in similar contexts. While a digital depression app is not a magic bullet solution to solve all depression issues, VMood shows promise as a low-cost and accessible intervention that could help improve mild to moderate depression in community-based settings, should results from the RCT demonstrate its effectiveness. Digital mental health services provide a possible solution to rapidly and effectively expand mental health care to the growing population with mental health needs.

Acknowledgements

N/A.

Conflicts of Interest

RWL has received honoraria for ad hoc speaking or advising/consulting, or received research funds, from: Abbvie, Asia-Pacific Economic Cooperation, Bausch, BC Leading Edge Foundation, Brain Canada, Canadian Institutes of Health Research, Canadian Medical Protective Association, Canadian Network for Mood and Anxiety Treatments, Carnot, CB Solutions, Genome BC, Grand Challenges Canada, Healthy Minds Canada, Janssen, Lundbeck, Michael Smith Foundation for Health Research, MITACS, Neurotorium, Ontario Brain Institute, Otsuka, Shanghai Mental Health Center, Unity Health, Vancouver Coastal Health Research Institute, and VGH-UBCH Foundation.

The other authors declare that they have no competing interests.

Abbreviations

ASW: Antidepressant skills workbook
CBT: Cognitive behavioural therapy
CHC: Commune Health Centre
GCC: Grand Challenges Canada
LMIC: Low-and middle-income country
MOH: Ministry of Health
MOLISA: Ministry of Labour, Invalids and Social Affairs
PHAD: Institute of Population, Health and Development
PHQ-9: Patient Health Questionnaire-9
RCT: Randomized controlled trial
SPC: Social Protection Centre
SSM: Supported self-management

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