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Developing Meditation Practice in Individuals with Elevated Psychological Distress via a Meditation App Intervention: An Implementation Science-Informed Qualitative Investigation of Barriers and Facilitators

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Abstract

In recent decades, depression and anxiety have worsened among American adults. Meditation apps may provide an accessible route for reducing these symptoms. However, many users experience barriers to persisting in their use of these apps. Prior research has identified psychosocial and practical barriers and facilitators to the use of meditation apps, as well as barriers and facilitators related to the apps themselves. Yet few prior studies have drawn on frameworks from the highly relevant field of implementation science such as the Consolidated Framework for Implementation Research (CFIR). A lack of unifying implementation science frameworks has limited shared language to describe barriers and facilitators and has made it challenging to identify and account for multi-level factors impacting the implementation of meditation apps. As such, this study used CFIR to explore the implementation of the Healthy Minds Program meditation app among users experiencing elevated depressive and/or anxiety symptoms. Participants (n = 20) were drawn from a meditation dosage clinical trial and interviewed about their experiences establishing a meditation practice using the Healthy Minds Program app. Using CFIR and deductive qualitative content analysis, four categories were generated: Practical Facilitators to Developing a Meditation Practice, Motivations for Developing and Maintaining a Meditation Practice, Barriers to Developing a Meditation Practice, and Recommendations for Improving the App. Overall, participants reported positive outcomes from their practice which, for some,

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Rachel L. Dyer: Data curation, formal analysis, investigation, methodology, project administration, supervision, writing—original draft preparation; Katherine M. Zimmerman: Formal analysis, writing—original draft preparation; Xinxuyang Zhao: Formal analysis, writing—original draft preparation; Qiang Xie: Writing—original draft preparation, writing—review and editing; Cortland J. Dahl: Writing—review and editing; Andrew Quanbeck: Writing—review and editing; Simon B. Goldberg: Conceptualization, funding acquisition, project administration, resources, supervision, writing—review and editing.

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motivated their continued use of the Healthy Minds Program app. Future research should consider how barriers and facilitators may change over time with increased engagement and experience with meditation apps and practice.

Keywords

meditation-based interventions; depression; anxiety; digital technology; access to care

Depression and anxiety have become significant public health issues in the last several decades. Since the turn of the 21st century, American adults have reported worsening mental health, including increasing rates of depression (Udupa et al., 2023) and anxiety (Goodwin et al., 2020). With the COVID-19 pandemic, rates of depression, anxiety, and associated disorders further increased (Twenge & Joiner, 2020). The United States National Institute of Mental Health (NIMH) reports that approximately 8.3% of American adults experience a major depressive episode each year and that 19.1% experience any anxiety disorder in a given year (NIMH, 2023; n.d.). Depression and anxiety not only cause emotional suffering and reduce individuals' quality of life but also pose a significant economic burden on society (Greenberg et al., 2023). Unfortunately, only 61% of American adults who experienced a major depressive episode in the last year and 42.3% of those with any anxiety disorder, received treatment (Alonso et al., 2018; NIMH, 2023). Given the impact of depression and anxiety on individuals and society, it is imperative to disseminate interventions to alleviate these conditions.

Mental health apps (i.e., smartphone applications for preventing and treating mental health concerns) are a promising approach to addressing depression and anxiety on a population level. Mental health apps have the potential to increase accessibility and scalability of mental health support and reduce costs compared to traditional psychotherapy treatment. Indeed, data from the Google Play Store indicated that by the end of 2018, mental health apps had been downloaded more than 90 million times, reflecting their broad reach. However, despite relatively high engagement among active users, the majority of individuals who had these apps installed did not engage with them on a typical day, with a median open rate of 4.0% (Baumel et al., 2019). Mental health apps have been utilized to improve a wide range of mental health and well-being outcomes, such as psychological distress, smoking cessation, suicidal ideation, quality of life, mindfulness, and self-compassion (Goldberg et al., 2022). A comprehensive review and meta-analysis of 176 randomized controlled trials found that mental health apps had a small effect on anxiety ($g = 0.26$) and depression ($g = 0.28$) compared to control conditions (Linardon et al., 2024).

Meditation apps (i.e., smartphone apps that deliver training on meditative techniques) play a prominent role in the landscape of mental health apps by reaching a substantial portion of the user base (Wasil et al., 2020). Potentially in response to increased depression and anxiety in the last several decades, meditation app use has gained popularity in the United States of America (US). According to a population-based survey study, more than half of American meditators have used meditation apps with nearly 25% using the apps weekly or daily to facilitate their practice (Lam et al., 2023). Meditation apps have been found to result

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in positive mental health effects, particularly if the apps are used long-term (Gál et al., 2021; Linardon et al., 2023). Moreover, increased meditation and use of meditation apps have been linked to greater improvements in mental health outcomes (Callahan et al., 2024; Goldberg et al., in press).

Barriers to Engagement with Meditation Apps

While meditation apps appear supportive of mental health, many individuals face barriers to establishing and persisting in their meditation practice and app use. The majority of meditation app users appear to fail at persisting in their use of the app, with the same study finding that only 4.7% of users were still using meditation apps 30 days after downloading them (Baumel et al., 2019). As mentioned, this is comparable to other health and mental health apps, which find dramatic reductions in use after initially downloading the tool (Baumel et al., 2019; Torous et al., 2018). Users may experience psychosocial barriers, as well as practical barriers and those related to the intervention itself, such as content and design.

Psychosocial barriers include difficulty changing mental habits (Banerjee et al., 2017), low motivation for practice (Xu et al., 2021), and emotional distress (Laurie & Blandford, 2016). For app users with heightened psychological distress, they may cease practice because meditation is distressing or due to the improvement of their symptoms (Goldberg et al., 2022; Lam et al., 2023). Psychosocial barriers may also result from practical barriers or barriers related to the intervention. For example, app users may prefer or require shorter meditations or the flexibility to skip long or personally irrelevant content. As this is not always possible depending on the app, users may experience decreased motivation to continue engaging with the intervention or may cease engagement altogether if they are not able to use the app in their preferred way (Crosby & Bonnington, 2020; Xu et al., 2021).

Practical barriers include difficulty finding time or a private location to practice or fitting meditation into one’s schedule, feeling that meditation practice is a burden (Xu et al., 2021). These practical barriers have also been reported by app users experiencing heightened psychological distress (Xie et al., 2024). Users may also encounter barriers related to the specific meditation app, such as disliking app content or design (Laurie & Blandford, 2016). Some users feel that reminders sent by meditation apps are invasive and stressful or that they do not occur at opportune times in their schedule, thus failing to effectively promote engagement with the intervention (Xu et al., 2021). For others, they prefer interacting with peers or professionals, noting that using a self-guided, digital intervention felt isolating or not tailored enough to their individual needs (Crosby & Bonnington, 2020). For some users and interventions, financial cost is a barrier (Xu et al., 2021). To our knowledge, there have been no qualitative examinations of how barriers experienced by app users with elevated depression, anxiety, or both.

Facilitators of Engagement with Meditation Apps

While barriers to using meditation apps are present, there are also factors which facilitate their use. Some psychosocial factors may increase engagement with meditation apps. The

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perceived benefits of digital interventions appear to provide sufficient motivation to facilitate continued use (Crosby & Bonnington, 2020). Meditators who hold more positive subjective beliefs about meditation and believe that their meditation practice is benefiting them are more likely to persist in their practice (Lam et al., 2022; Xu et al., 2021). This appears congruent with the finding that a leading motivation for meditation practice is addressing mental health concerns (e.g., Jiwani et al., 2022). Users have also identified facilitators related to the content or design of meditation apps. These include the personalization of content, appearance, and notifications; the simplicity of content, appearance, and features; accessibility and flexibility of use and knowing the evidence base of intervention or that the intervention provided relevant educational information and skills (Crosby & Bonnington, 2020; Xu et al., 2021). Like barriers, we did not find any qualitative studies of how app users with elevated depression, anxiety, or both experience facilitators to app use, limiting the scope of understanding how to specifically deploy, improve, or supplement meditation apps for this population.

Understanding Barriers and Facilitators Associated with Meditation App Use Through Implementation Science

Implementation science provides potentially valuable frameworks for extending prior work on barriers and facilitators of meditation app use. Implementation science is an increasingly popular approach that has been used to understand barriers and facilitators related to a wide variety of interventions across healthcare. Implementation science aims to bridge research and practice by focusing on the methods and strategies that bring evidence-based interventions into daily practice (Bauer & Kirchner, 2020). One widely used implementation science framework is the Consolidated Framework for Implementation Research designed to promote the uptake of research evidence in policy and practice (CFIR; Damschroder et al., 2022). The current CFIR model includes 46 constructs across five domains describing contextual factors that may facilitate, or act as a barrier to, implementation: the intervention itself (Innovation Domain), the setting in which the intervention is implemented (Inner Setting Domain), the broader context of the implementation setting (Outer Setting Domain), the individuals involved in implementation (Individual Domain), and the process of implementation (Process Domain; Damschroder et al., 2022). CFIR has been increasingly used to explore the implementation factors associated with traditional (Hudson et al., 2020; Lebares et al., 2020) and online, synchronous meditation interventions (Muñoz Bohorquez et al., 2023).

As discussed above, research has begun identifying barriers and facilitators associated with engagement with meditation apps. However, few studies have adopted CFIR to examine the implementation factors related to engagement with self-guided meditation apps. CFIR can help in comprehensively and systematically identifying and categorizing multi-level factors influencing the implementation of self-guided meditation apps. This may generate more thorough insights grounded in the broad implementation science literature relative to atheoretical investigations. Applying CFIR may ultimately inform multilevel strategies to increase engagement with meditation apps and practice. Moreover, utilizing a theoretical framework like CFIR may allow for consistency in terminology and constructs across

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studies. This may increase the replicability and comparability of findings in different studies compared to not using a theoretical framework.

The Current Study

Given the limited understanding of how meditation app users with elevated depression, anxiety, or both experience using these apps, the purpose of the current study was to examine the barriers and facilitators associated with the implementation of the Health Minds Program (HMP) app as reported by users with these symptoms. To best capture the experiences and needs of these users, a qualitative approach was indicated. Given its strengths, we used CFIR to guide this exploration. The meditation app examined, HMP, was built on a well-being model supported by extensive neuroscientific research (Dahl et al., 2020). Moreover, HMP is freely downloadable and has been downloaded over 1 million times. HMP has been found to enhance mental health in randomized control trials (Goldberg et al., 2020; Hirshberg et al., 2022). Thus, HMP is a relevant context for studying app engagement that may yield insights with the potential to reduce the public health burden of depression and anxiety.

To understand the barriers and facilitators associated with the implementation of HMP, we conducted qualitative interviews with participants following a 4-week HMP intervention. These participants were drawn from a randomized clinical trial on the effects of daily meditation practice dosages (i.e., 5 vs. 15 minutes per day) on symptoms of depression and anxiety; the manuscript capturing the findings from this main study are in preparation. Using CFIR as a scaffolding theoretical framework (Damschroder et al., 2022), we conducted a deductive qualitative content analysis to explore the barriers and facilitators associated with the implementation of HMP (Elo & Kyngäs, 2008). Deductive qualitative approaches use existing frameworks to examine data. Relative to other qualitative methods, this approach enhances comparability across studies given consistent framework use rather than data-derived themes, allowing scholars to re-examine both the framework and prior findings to support, refute, or add greater specificity to the literature (Fife & Gossner, 2024). Taking a qualitative (rather than quantitative) approach allowed us to center how and why participants experienced implementation barriers and facilitators, fitting them into the CFIR scaffolding framework. Our research question was as follows: How do these RCT participants describe their experiences developing their meditation practice using the HMP app?

Method

From the randomized trial, 92 participants with elevated depression and/or anxiety symptoms (Patient-Reported Outcomes Monitoring System T-scores > 55; Choi et al., 2014; Schalet et al., 2014) were randomly assigned to 5 or 15 minutes of daily use of the HMP app for four weeks. The randomized trial intended to test the effectiveness of the HMP app, the dose-response relationship, and the feasibility and acceptability of randomly assigning participants to different meditation practice dosages. Participants completed four-times daily ecological momentary assessments via smartphone-delivered surveys throughout the four-week study period, as well as self-report questionnaires at the start and end of the study period. The trial was approved by the Institutional

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Review Board at the University of Wisconsin-Madison and was preregistered at clinicaltrials.gov (NCT05229406) and the Open Science Framework (https://osf.io/fszvj/?view_only=9cb1b9e67cc042f9bc7a0309e94b2f52).

Participants and Procedure

Study participants were adults without substantial meditation practice who demonstrated clinically elevated anxious and/or depressive symptoms. Exclusion criteria included more than one year of weekly meditation practice, daily meditation practice in the prior six months, prior practice under a meditation teacher (excluding introductory coursework), or prior participation in a meditation retreat. Also excluded were those demonstrating severe depression (Patient-Reported Outcomes Monitoring System Depression T-score > 70; Kroenke et al., 2020) and those at risk for alcohol use disorder (Alcohol Use Disorder Identification Test; ≥ 4 for men and ≥3 for all other genders; Aalto et al., 2009).

Following the four-week study period, participants received an email inviting them to take part in an exit interview about their experiences of study procedures and their meditation practice. Of the 89 participants who completed the clinical trial, 28 were invited for interviews; we aimed to have approximately equal representation of high and low app users, as well as high and low responders of the daily ecological momentary assessments. Racial/ethnic minority participants were also oversampled to encompass diverse perspectives. Three did not respond to the invitation, four stated that they were unavailable to be interviewed, and one expressed disinterest. Twenty-one participants expressed interest in being interviewed, and 20 completed interviews. The participants who completed the interview did not differ from the remainder of the randomized sample in regard to age (means = 35.95 and 29.99, SD = 18.38 and 11.06, respectively, $p = .072$), identifying as a woman (85.0% and 80.6%, respectively, $p = .651$), identifying as non-Latinx White (60.0% and 61.1%, respectively, $p = .928$), or baseline psychological distress (means = 60.18 and 61.23, SDs = 5.43 and 5.25, respectively, $p = .435$). Interviews occurred on average 8.70 days after post-test (SD = 3.59).

One interviewer (RLD), a qualitative researcher with some familiarity with the HMP app and personal engagement with meditation for stress and sleep management, conducted all interviews. The interviews ranged in duration from 23 to 39 minutes. So that participants could take part in interviews from a location of their choosing, all interviews took place on Zoom. All interviews were recorded using embedded Zoom recording. Participants were compensated $100 for completing the pre- and post-test assessments and an additional $50 for completing an average of 3 ecological momentary assessments per day, provided they completed pre- and post-test assessments. Those who completed the exit interview received $20. As shown in Table 1, the demographics of the 20 participants were as follows: 35.95 years on average (standard deviation = 18.38, range [18, 80]); 85.0% female, 15.0% male; 60.0% non-Latinx White, 25.0% Asian, 5.0% Latinx White, 5.0% Black or African American, 5.0% American Indian.

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Intervention

The four-week meditation intervention was provided by the free HMP app. The HMP app is designed to build skills in four pillars of well-being: Awareness, Connection, Insight, and Purpose (Dahl et al., 2020; Goldberg et al., 2020; Hirshberg et al., 2022). The Awareness module builds attention, mindfulness, and meta-awareness skills; the Connection module fosters compassion, kindness, and appreciation; the Insight module supports development of self-knowledge concerning the role that thoughts, emotions, and beliefs play in shaping experience; and the Purpose module facilitates the clarification and application of personally meaningful motivations and values (Dahl et al., 2020). Across modules, guided sitting and active (i.e., intended to be completed while engaging in day-to-day activities like folding laundry) practices are provided along with psychoeducation on the science of well-being.

Measures

The semi-structured interview protocol included nine questions (e.g., “As a part of the study, we asked you to practice meditation a certain amount every day. How did that go?”) with optional probes included (e.g., “What factors supported your ability to stick with your meditation practice?;” see Appendix A). The initial interview protocol was developed through collaboration between the last author and a PhD student with expertise in interview-based qualitative methods; this draft protocol was then reviewed and finalized by the first author. Additional questions about informal practice were added by the fourth author after four interviews were completed. Throughout each interview, the interviewer inquired about further detail as indicated using probes as well as those stemming from participant responses. Responses to the question regarding informal practice (i.e., spontaneous incorporation of meditation practice into daily activities; see Appendix B) have been published elsewhere (Xie et al., 2024) and are not included in the current study. Further, the current study analyzed data only relevant to participants’ use of the app. We do not report results related to their engagement with study procedures. Interviews were transcribed using the Zoom transcription feature, then further edited for accuracy by the first, second, and third authors. Participants also completed a demographics survey (see Appendix C).

Data Analysis

Data were analyzed using deductive content analysis, as detailed by Elo and Kyngäs (2008). Six members made up the study team: a qualitative researcher and PhD candidate in counseling psychology whose work is primarily focused in another area (pregnancy-related experiences; RLD); a recent graduate with a B.S. in psychology and current research coordinator for a technology-based meditation intervention study (XZ); a recent graduate with a B.S. in psychology and sociology (KZ); a counseling psychology PhD student who studies the development, optimization, and implementation of technology-based meditation interventions (QX); an implementation scientist who studies the implementation and dissemination of technology-based interventions (AQ); and the principal investigator—a counseling psychologist who studies psychotherapy, meditation, and digital interventions (SBG).

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Content analysis involves three phases: preparation, organizing, and reporting (Elo & Kyngäs, 2008). In the preparation phase, it was determined that only manifest content (i.e., participants' literal words, rather than underlying meaning) from all responses apart from those pertaining to informal practice (Xie et al., 2024) would be analyzed to avoid potential biased misinterpretation of participant tone (Elo & Kyngäs, 2008). To support investigator triangulation (i.e., working to reduce bias by involving multiple researchers in analysis), the second and third authors also acted as coders under the supervision of the first author (Denzin, 2015; Fusch et al., 2018).

During the organizing phase, all three investigators involved in coding familiarized themselves with the data by conducting numerous, independent readings of all interview transcripts (Elo & Kyngäs, 2008). Using CFIR, the investigators then developed a structured categorization matrix, selecting relevant CFIR domains into which data were fit (Damschroder et al., 2022; Elo & Kyngäs, 2008). The first CFIR domain selected was Innovation, capturing factors pertinent to the "thing" being implemented. For this study, the innovation referred specifically to the HMP app, not meditation broadly or without the app. The Innovation domain includes eight constructs: 1) *Source*, the credibility of the individuals/group that created the innovation; 2) *Evidence Base*, the robustness of evidence supporting the innovation; 3) *Relative Advantage*, how much better this innovation is compared to competitors; 4) *Adaptability*, the extent to which the innovation can be modified to context; 5) *Trialability*, the extent to which the innovation can be piloted; 6) *Complexity*, the scope and steps involved in the innovation; 7) *Design*, the packaging and presentation of the innovation; and 8) *Cost*, the price of the innovation. The second CFIR domain was Individuals, specifically the Individual Characteristics subdomain which captures the attributes of those involved in implementing or receiving the innovation. This subdomain includes four constructs: 1) *Need*, individual deficits addressed by the innovation; 2) *Capability*, individual knowledge and ability to engage with innovation; 3) *Opportunity*, individual power to engage with innovation; and 4) *Motivation*, commitment to engaging with innovation (Damschroder et al., 2022). See Table 2 for a summary of these definitions (with specific adaptations for this study), as well as example participant quotes.

The two coders (KZ and XZ) then reviewed all data and independently coded the data for each selected CFIR construct. Any disagreement between coders was discussed and clarified in discussion with the first author, who audited the coding process ongoingly. Throughout coding, an audit trail was maintained by adding further specification to the categorization matrix, documenting coder decisions, and noting construct relevancy to the data. To build credibility (Lincoln & Guba, 1986), this more specific categorization matrix was compared back to the data and adjustments, or further specification, added as indicated.

Transitioning into the reporting phase, the investigators engaged in abstraction, collapsing the CFIR constructs (Damschroder et al., 2022) into similar groups to form categories for concise reporting (Elo & Kyngäs, 2008). Our abstraction process was explicitly guided by our research question (i.e., How do these RCT participants describe their experiences developing their meditation practice using the HMP app?) which we continuously referenced when deciding how to collapse constructs and in what order to present participants' data. We first summarized all participant quotes to highlight similarities and differences within

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each CFIR construct, then combined this information through narrative writing. We then examined content relatedness between constructs to determine a cogent presentation of the data, noting connections about things that both helped and hindered meditation practice development using the app, motivation to meditate including a sense that the app was improving their mental health, and recommendations for how the app could be improved in service of meditation practice development. Through this process, two constructs were split across categories to capture facilitators and barriers more clearly—*Opportunity* and *Capability*. From here, the first, second, and third authors reported the categories in the form of the following Results section.

Results

To address our research question (i.e., How do these RCT participants describe their experiences developing their meditation practice using the HMP app?), analysis yielded four categories, collapsed from 10 CFIR constructs (*Source*, *Evidence Base*, *Relative Advantage*, *Adaptability*, *Design*, *Cost*, *Need*, *Capability*, *Opportunity*, *Motivation*; Damschroder et al., 2022)—Practical Facilitators to Developing a Meditation Practice, Motivations for Developing and Maintaining a Meditation Practice, Barriers to Developing a Meditation Practice, and Recommendations for Improving the App. See Table 2 for more information about the CFIR constructs, the adjusted study definitions, and the study categories into which the constructs were collapsed (Damschroder et al., 2022). The CFIR constructs, *Complexity* and *Trialability*, under the Innovation domain were removed from the categorization matrix as they did not appear in the data relevant to participants experiences developing a meditation practice (Damschroder et al., 2022). Please note that when participants referred to using the app, due to the study requirements, it is assumed that this meant they were meditating or engaging in a lesson about meditation.

Practical Facilitators to Developing a Meditation Practice

This first category, Practical Facilitators to Developing a Meditation Practice, captured the tangible and logistical facilitators for participants in developing their meditation practice using the app—both from the app itself as well as in participants' own daily life. Six CFIR constructs comprise this category (note percentages are of total quotes across all categories, $n = 372$ total quotes): *Design* ($n = 81$ responses; 21.8%), *Source* ($n = 3$ responses; 0.8%), *Relative Advantage* ($n = 5$ responses; 1.3%), *Cost* ($n = 6$ responses; 1.6%), *Opportunity* ($n = 50$ responses; 13.4%), and *Capability* ($n = 32$ responses; 8.6%; see Table 2). For *Opportunity* and *Capability*, only data suggesting that participants have the availability, environment, knowledge, and skills to meditate using the app as required by the study were included; data to the contrary were included under a different category (Barriers to Developing a Meditation Practice; Damschroder et al., 2022).

This category is comprised primarily of participant statements aligning with the CFIR *Design* construct as participants found the HMP app layout, content, and customizability to be useful in facilitating their meditation practice. Directly related to app design, some participants made explicit comparisons to other meditation apps, aligning with the CFIR *Relative Advantage* construct, as the HMP app was positioned as the preferred option.

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Several participants noted another advantage of the HMP program app—that it was free to use even after the end of the study, congruent with the CFIR *Cost* construct (Damschroder et al., 2022; see Table 2).

Aligned with *Design*, many participants noted how the HMP app was user-friendly and aesthetically pleasing—highlighting the layout, colors, font, and illustrations (Damschroder et al., 2022; see Table 2). The progress tracking visuals, including the meditation timer and depictions of their learning path through modules, were viewed as easy to understand, motivating, and rewarding. Most participants favored the step-by-step module structure that provided a helpful overview of upcoming meditations. Emphasizing the inclusion of education alongside meditation, one mentioned, "I liked how there was a lesson before your meditation, so you understand what you were trying to train your mind to do" (Participant 12, Non-Latina White, 23). Another participant expressed appreciation about having a "next" button for moving to the following practice without searching. Other participants appreciated the opportunity to explore additional content outside of the modules: "I liked the extra set of practice modules that they have because I personally feel like I'm learning when I practice as much as I can" (Participant 4, Asian, Male, 21).

In terms of content, most of the participants felt the app provided a positive meditation experience through evoking relaxation, providing words of encouragement, and helping them maintain concentration during their practice. Connecting both the CFIR *Design* and *Relative Advantage* constructs (Damschroder et al., 2022; see Table 2), one participant (Participant 15, Asian, Female, 27) found the HMP app to be more validating and supportive than other apps:

> I've tried other mindfulness apps before, and I liked the way this app worked. (…) A lot of validation, I was receiving from [the HMP app] which I didn't get from other apps. [The other apps] just tell you what you should be doing and, "Why aren't you doing this?" So, I liked a lot of like what [the HMP app] was saying.

Aligned with the CFIR *Source* construct, multiple participants also noted the positive impact of the explicit research basis of the HMP app in supporting their engagement and understanding rationale behind the app content (Damschroder et al., 2022; see Table 2). For example, one participant referenced the Center for Healthy Minds founder, who spoke during the initial lessons of the app, which lent credibility to the content. Related to both the CFIR *Source* and *Capability* constructs (Damschroder et al., 2022; see Table 2), a few participants had prior knowledge of the uses and benefits of meditation, with one participant mentioning: "I'm Buddhist. So, I read a lot of Buddhist books (…) Meditation is a really big part of the Buddhist practice. I know about it through reading, and I know it's good for you" (Participant 7, Asian, Female, 25).

Participants appreciated the option to customize their meditation practice, such as choosing between two meditation narrators, or between sitting and active meditations. A few participants noted how the sitting or active meditation options made it easier to practice based on their preferences and ability to concentrate. A few participants mentioned that the ability to enable notifications within the HMP app helped them adhere to their meditation dosage: "I did appreciate that the app had the option to set reminder notifications.

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Sometimes those were helpful" (Participant 6, Non-Latina White, 25). Indeed, a couple participants found the HMP app helpful in developing their meditation practice because the app format was easier to stick with over time as compared to something like a meditation class—again congruent with the CFIR *Relative Advantage* construct (Damschroder et al., 2022; see Table 2). As one participant put it, "It's very easy to self-initiate [a meditation practice] when you're able to do it [on an app], as opposed to signing up for a meeting where you might miss it" (Participant 14, American Indian, Female, 54).

While many practical facilitators identified by participants related to the app, others originated from participants themselves. Aligned with the CFIR *Opportunity* construct, participants noted ways in which their daily life practically supported the development of their meditation practice (Damschroder et al., 2022; see Table 2). For example, a few participants noted how important their physical environment was for facilitating the opportunity to meditate, including being alone, in spaces that produced a sense of comfort, and had minimal distractions. Other participants spoke about their schedules. Those with variable schedules noted how the flexibility granted by the HMP app allowed them to sustain their practice even with different daily routines. Participants with set schedules also appreciated the ability to choose where and when they would meditate, with some noting that they could still sustain their practice even when their routine was disrupted. Some participants explained that the app helped them develop a routine for meditation based on when practice felt more needed. As one participant (Participant 18, Non-Latina White, 30) put it:

> I would wake up in the morning and I'd usually listen to my lesson for the day, to help me get in the right mindset (…) as time went on, I tried implementing [the meditations] into when I specifically felt like I needed them most within the day, which I thought was a better use of it for me, personally. Sometimes, if I had something that was making me anxious—going to class—I would listen to it then. Sometimes, if I just found some quiet time and I wasn't really doing much at home, I'd listen to one of the still meditations.

In sum, the app *Design* broadly captured the practical facilitators identified by participants. Some participants made comparisons to other apps or ways of learning and engaging with a meditation practice, noting that the HMP had *Relative Advantage* over those options including in *Cost* or through the *Source* of its research-driven design. Related to the participants themselves, they identified various *Opportunities* in their environments and schedules to be able to engage with the app and their meditation practice, as well as the *Capability* or existing knowledge to support developing a meditation practice (Damschroder et al., 2022; see Table 2).

Motivations for Developing and Maintaining a Meditation Practice

The second category, Motivations for Developing and Maintaining a Meditation Practice, captured the psychosocial facilitators that participants identified as supporting their meditation practice using the app—motivation to cultivate a meditation practice participants had *prior to* initiating the practice (e.g., wanting to improve mental health), as well as motivation to continue meditating acquired *by way of* practicing meditation (e.g.,

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experiencing stress reduction). Three CFIR constructs comprise this category: *Evidence Base* (*n* = 39 responses; 10.5%), *Need* (*n* = 28 responses; 7.5%), and *Motivation* (*n* = 55 responses; 14.8%; see Table 2; Damschroder et al., 2022).

Congruent with the CFIR *Need* construct, prior to initiating their practice, participants identified several motivating factors to developing and maintaining a meditation practice (Damschroder et al., 2022; see Table 2). For some participants, the use of meditation for alleviating or preventing mental health concerns, such as depression or anxiety, was motivating. As one participant (Participant 2, Non-Latina White, 47) put it, "…just wanting to see if [meditating] would help me manage my anxiety a bit better if I tried it for four weeks straight." For another participant with a family history of depression and anxiety, they were motivated to use meditation prophylactically to mitigate the risk of their own mental health worsening. Aligned with the "personal fulfillment" aspect of the CFIR *Need* construct, for a few participants, sheer curiosity appeared to motivate them to pursue and stick with their meditation practice (Damschroder et al., 2022; see Table 2). One participant (Participant 3, Non-Latina White, 18) framed it this way, simply stating, "I was really curious about the app and the study, and I wanted to hear all of the lessons and meditations to learn new things."

Congruent with the CFIR *Motivation* construct, participants identified motivators for developing and maintaining their practice that arose *as they engaged* in their practice (Damschroder et al., 2022; see Table 2). For example, a few participants mentioned that having the app on their phone and receiving notifications motivated them to continue mediating during and after the study. For example, one participant (Participant 17, Non-Latina White, 62) described how the notifications supported her ability to think about the app throughout the day, maintaining motivation to meditate in the evening:

> I liked how in the mornings [the app] would remind me… because I would have just started my day, but never thought about [meditating] until the end of the day. [Without the notifications,] I probably would have thought, "Oh, I'm too tired now to do this." Instead, it was always in the back of my mind. "I've got to make time for this, for me."

Additionally, a few participants explained that the routine of using the app motivated them to continue their meditation practice. One participant (Participant 15, Asian, Female, 27) noted that meditation was something she could return to, even when her schedule became busier, "My life got busy, but I picked [meditating] back up and I realized that I could do this. It was fine, [meditating] would fit into my life."

Other participants found the structure of the app's meditation practice helpful in maintaining motivation. For example, two participants found that the brevity of some meditation options motivated them to continue their practice as those meditations facilitated reflection and understanding of lessons, as well as supported participants' sustained attention. Both of these participants also noted that briefer options were helpful in the earlier days of the study, when they were using meditation to build their capacity to concentrate. As one participant (Participant 19, Non-Latina White, 26) put it, "[A] goal of mindfulness is to be better about focusing your attention. But it's a work in progress, especially when you first start." Overall,

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how the app presented meditation made developing a practice feel more attainable. One participant (Participant 20, Non-Latina White, 26) said:

> I think [practicing meditation using this app] was a good first-step in realizing just how attainable and- easy is not the right word, because it is something that requires practice, but easy to get started…

Aligned with the CFIR *Evidence Base* construct, several participants mentioned the positive effects they experienced as a result of meditation which, in turn, motivated them to continue developing their meditation practice throughout the duration of the study and maintaining it after (Damschroder et al., 2022; see Table 2). As one participant (Participant 4, Asian, Male, 21) put it, "I knew the feeling I got out of meditating was worth my time […] I could see the [change] in my life—it was a positive [change], so, that kept me [wanting] to continue this habit." Other participants shared positive changes as a result of meditation such as reduced stress, improved concentration, and improved interpersonal relationships motivating them to maintain their practice and explore additional lessons and meditations within the app. One participant (Participant 19, Non-Latina White, 32) noted that these positive changes were not always comfortable or calming, but that the meditation helped overall: "Meditation is not always exactly calming (…) it centers you and takes you out of whatever spiral of thoughts you might be in. You might be really concentrating on whatever is happening in front of you, to an unproductive degree."

Aligned with both the CFIR *Motivation* and *Evidence Base* constructs, some participants experienced multiple sources of motivation or shifting forms of motivation over time (Damschroder et al., 2022; see Table 2). For example, one participant (Participant 18, Non-Latina White, 30) described her motivation transforming from extrinsic to intrinsic throughout the study, attributing this to experiencing different motivating factors:

> I think [what motivated me] was the app. I like having little motivators like being able to see how many [meditations] out of three I've done for the day. Getting that fulfilled was motivating enough. (…) Over time, seeing that I did feel a lot calmer after I would do the meditations, and feel like my mind was freed up became very motivating. I kind of shifted from extrinsic to intrinsic.

The CFIR *Motivation* construct appeared to persist following the study as several participants intended to continue their meditation practices using the app. Some did not clearly state what motivated their plans to maintain their practice, but others—congruent with the CFIR *Need* construct—shared motivators like curiosity about the remaining app content, as well as the hope to continue benefitting from meditation and developing a daily practice habit (Damschroder et al., 2022; see Table 2).

A different form of the CFIR *Motivation* construct, numerous participants felt motivated to engage in their practice because they were participating in a research study (Damschroder et al., 2022; see Table 2). For some, the mere knowledge that they and others were study participants acted as a form of motivation or accountability. For others, they expressed a sense of responsibility to engage with the study to the best of their ability; as one participant put it, "I wanted to be a good participant, so [there was a] sense of obligation to fulfill the commitment I made." (Participant 2, Non-Latina White, 47). One participant noted that

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participating in this study provided them with the momentum to continue their meditation practice, which they believed may not have been possible without the structure of the study. Some participants found the study procedures, such as the daily surveys, motivating as they facilitated deeper engagement with their meditation practice. One participant shared how completing daily study surveys afforded him moments to reflect: "…surveys have a therapeutic value, too, if you think about it. Because if you have to concentrate on how you're feeling at that moment, it gives you clarity as to where you are in your efforts to understand yourself better." (Participant 5, Non-Latino White, 69) Although some participants found being in a study to be motivating, a few mentioned that feeling obligated to meditate could *adversely* impact their motivation to practice. As one participant (Participant 20, Non-Latina White, 26) put it:

> But then over the last two weeks, I didn't even care that much anymore. I just had to [meditate] to check it off the list. Some of the days, I just don't want to [meditate], and it felt like I was like, "Okay, just do it to get it done." Which seemed counterintuitive to the purpose of meditation, in my opinion.

It seems that while engaging with meditation practice as a study participant may have afforded motivation to persist in their practice, for some participants, being a study participant may have decreased the level of genuine engagement with their practice.

In sum, participants had identified *Need* for engaging in the study and developing a meditation practice. Prior to, during, and after the study, participants reported diverse sources of *Motivation* for developing and maintaining their meditation practice using the HMP app. Notably, several participants noticed acquiring an *Evidence Base* of the effectiveness of the app and meditation on their *Needs*, which further enhanced their *Motivation* to maintain their practice (Damschroder et al., 2022; see Table 2).

Barriers to Developing a Meditation Practice

The third category, Barriers to Developing a Meditation Practice, captured participants' reported difficulties with developing a meditation practice using the app—both in terms of their social and physical environment (i.e., *Opportunity*) and their own knowledge and skills (i.e., *Capability*). As such, the two CFIR constructs that comprised this category were *Opportunity* (n = 22 responses; 5.9%) and *Capability* (n = 25 responses; 6.7%; see Table 2). Only data suggesting that participants *did not* have the *Opportunity* or *Capability* to meditate using the app as required by the study were included; the remainder of *Opportunity* and *Capability* were described above under Practical Facilitators to Developing a Meditation Practice (Damschroder et al., 2022).

Aligned with the CFIR *Capability* construct, many participants identified difficulties with concentration as a barrier to their meditation practice (Damschroder et al., 2022). One participant identified her age as a possible reason for why concentrating during her practice was difficult: "I think [if I was] a little younger, I could focus more" (Participant 10, Black or African American, Female, 80). Some participants assigned to the 15-minute meditation group noted that it was challenging to remain attentive during the entire 15 minutes: "It was harder for me because it was 15 minutes. It's harder for me to focus for that longer period of time" (Participant 3, Non-Latina White, 18). Another participant in the 15-minute

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group noted that, on some days, 10 minutes would have been sufficient for both meeting their goals for meditating and suiting their attention span. Others used the app in particular ways to enhance their own ability to concentrate, such as choosing one type of meditation over another. For example, one participant preferred sitting meditation due to concerns about concentration throughout an active meditation: “If I was doing something while I was practicing, I wouldn’t be able to concentrate. So, I chose the sitting [meditation option]” (Participant 10, Black or African American, Female, 80).

A few participants described a direct relationship between concentration and motivation, such that a lack of concentration decreased their motivation to engage in their practice. Being unable to concentrate generated feelings of dejection, which reduced motivation to continue engaging in the practice. As one participant put it, “I think meditation is just really challenging in itself, and it can be easy to get discouraged and disheartened when your mind is wandering. It feels like you’re really bad at it. (…) Should I even do it at all?” (Participant 12, Non-Latina White, 23). Other participants identified feelings of guilt for not being able to concentrate during the entirety of a meditation session but did not connect guilt to a lack of motivation specifically.

Congruent with the CFIR *Opportunity* construct, other participants spoke about how their variable and busy schedules presented barriers to their meditation practice. Here, schedules impacted participants’ ability to concentrate—relating also to *Capability*—as well as find the time to meditate (Damschroder et al., 2022; see Table 2). As one participant (Participant 9, Asian, Female, 26) explained:

> I know that the point [of meditation] is that you’re supposed to take that time out of your day to do it but, I had a lot of other things going on. I was like, “I don’t have 15 minutes to do this.” [When I meditated,] I started thinking about what I’m gonna do during the day. So, a lot of the times when I was [meditating], I was distracted.

In addition to their schedule varying day-to-day, some participants identified that their ability to concentrate throughout each meditation session was also variable throughout the study.

Outside of impacts to concentration, only a few participants noted *Opportunity*—environmental or temporal—barriers to engaging in their meditation practice like work, school, or family responsibilities. As one participant put it, “I was at home a few times, and I found that harder because my family was around. So, I [don’t] think it’s easier to do when you’re not alone in a quiet environment” (Participant 3, Non-Latina White, 18). This participant also described the impact that both family responsibilities and the presence of young children at home can have on meditation practice.

In sum, participants mostly identified *Capability* concerns with concentration as the primary barrier to developing a meditation practice. This was connected to participants’ limited *Opportunities* to engage in their practice at times or in settings which felt conducive to concentrating on their practice (Damschroder et al., 2022; see Table 2).

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Recommendations for Improving the App

Recommendations for Improving the App is the fourth and final category. Aligned with one CFIR construct, *Adaptability* (n = 26 responses; 7.0%), this category captured the changes participants suggested for modifying, tailoring, or refining the app to suit additional contexts and needs (Damschroder et al., 2022; see Table 2). While the question about recommendations followed the question about barriers in the interview protocol, participants did not necessarily report clear connections between their identified barriers and the recommendations they put forth. However, a few participants did provide recommendations that were connected to concerns with concentration, motivation, their schedule, or the environment—CFIR *Opportunity* and *Capability* constructs (Damschroder et al., 2022; see Table 2). For example, a few participants indicated that they would have experienced similar benefits from shorter meditations, with one participant suggesting the addition of extremely brief meditations for app users who needed to squeeze in their practice out of necessity or scheduling constraints: "Very short meditations to be used urgently, if the user is feeling overwhelmed, or if the user has little time in their day" (Participant 1, Latina White, 22). Another participant (Participant 19, Non-Latina White, 32) recommended that the app should more rapidly cycle between the existing module topics (i.e., Awareness, Connection, Insight, Purpose) to help users maintain engagement and recall content.

> I really liked getting an introduction to each of the different aspects—Awareness, Connection. But I guess, I probably would like to keep mixing it up. After the first four weeks of the lessons, it goes to more Awareness—and it's 22 lessons of Awareness and 27 meditations of Awareness. That's a lot of Awareness! And maybe it's good to concentrate on just one area, but I think I would prefer having four lessons on Awareness, then four lessons on Connection, then four lessons on Insight, then four lessons on Purpose. And then cycle through that over and over. Because I feel like I forgot what some of the other [modules] wanted you to focus on as I was concentrating on just one.

Several participants noted how beneficial it was for them to visually track their progress through the app but suggested an additional feature—creating custom goals so that their meditation practice would be specifically adapted and rewarding to *them*. As one participant put it, "I think the ability to set goals which the app can respond to and then help you achieve those goals … is one example of how you can help people practice [meditation]" (Participant 16, Non-Latino White, 19). Similarly, some participants recommended the addition of customizable notification or reminder features, feeling that such a feature would have better supported their ability to fit their practice into their schedule. As one participant described, "If I could have programmed it to give me an audible reminder, [I] think that would help with integrating [meditation practice] into my schedule" (Participant 7, Asian, Female, 25).

Some participants recommended enriching the contents of the lessons and meditations, such as through storytelling, in order to enhance learning. As one participant put it, "The incorporation of more stories into [the lessons and meditations] because we're naturally storytellers. We naturally, as beings, prefer to learn through stories" (Participant 5, Non-Latinx White, Male, 69). Relatedly, another participant (Participant 1, Latina White, 22)

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emphasized the need for app content to be inclusive and sensitive to diverse life experiences and challenges:

> …one more thing is the privileged portion of it. (…) I know it's gonna be hard to cover all experiences 'cause not everyone goes through the same thing, but—for that one recording that I was talking about—having a home… just keeping [in mind] the things that others may not have.

A few participants recommended additional content to allow users' options for *what* to use to guide their meditation practice and *how* they might use the app to facilitate this. As one participant explained, "Offering more things is probably useful. People can have more freewill on what they want to practice" (Participant 16, Non-Latino White, 19). For example, another participant suggested: "…[adding] different types of meditations. I have learned on my own from the internet and different schools of Buddhism. (…) just knowing about [these options], I feel like that would be helpful" (Participant 4, Asian, Male, 21).

Some participants suggested creating new, adapted apps for specific populations—a suggestion distinct from suggestions about *inclusivity*. For instance, one participant recommended developing a meditation app tailored to K-12 students, aiming to provide accessible and age-appropriate mental health resources to support the well-being of younger individuals: "I'm wondering if there could even be a student-focused app, like K-12, I know mental health isn't necessarily discussed (…) until after high school or college, 'cause I learned about mental health in college. I wish it would be more accessible for younger people" (Participant 1, Latina White, 22). Similarly, another participant suggested creating a similar, but separate app tailored to individuals with physical or mental health concerns to support the alleviation of their specific symptoms and the improvement of their functioning.

Several participants suggested the addition of accessible features, such as allowing users to speed up or slow down lessons and meditations or providing subtitles: "I want to emphasize having a button to fast forward the speaker or slow down, too, just to make it more accessible for people (…) Definitely having subtitles for it to be more accessible" (Participant 1, Latina White, 22). Similarly, another participant proposed providing transcripts of the lessons and meditations for those who may need, or prefer, to read. A different accessibility recommendation, one participant suggested adding a feature that would allow them to continue their engagement more easily with a particular meditation topic or practice: "…If I liked a specific section, if I could just have a way to just keep going on that section instead of having to scroll down and find where I was (…). I think that would have been helpful" (Participant 15, Asian, Female, 27). Overall, it appeared that participants wanted to be able to easily engage with the app because they found the content and resource overall to be impactful and worthy of greater access.

Discussion

The current study aimed to explore barriers and facilitators to implementing meditation practice via the HMP app for users with elevated depression, anxiety, or both, addressing the following research question: How do these RCT participants describe their experiences developing their meditation practice using the HMP app? In contrast to prior studies

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examining general barriers and facilitators to meditation app engagement (e.g., Banerjee et al., 2017; Crosby & Bonnington, 2020; Goldberg et al., 2022; Lam et al., 2023; Laurie & Blandford, 2016; Xu et al., 2021), the current research is among the first to specifically target anxiety and depression while grounding its investigation in a theoretical framework in implementation science (i.e., CFIR). The findings discussed below may inform strategies to enhance engagement in meditation apps for anxiety and depression, ultimately increasing the scalability, accessibility, and efficacy of psychological support for anxiety and depression - two pressing public health concerns.

Through deductive content analysis (Elo & Kyngäs, 2008) of participant interviews (n = 20), four categories were developed from 10 CFIR constructs (Damschroder et al., 2022): Practical Facilitators to Developing a Meditation Practice, Motivations for Developing and Maintaining a Meditation Practice, Barriers to Developing a Meditation Practice, and Recommendations for Improving the App. From these results, we may infer—or take direct participant suggestion—about what implementation strategies we may apply to adopt and integrate the HMP app into usual care for depression, anxiety, or both. See Table 3 for a summary of study takeaways. The CFIR Expert Recommendations for Implementing Change (ERIC) model is a prominent approach for tracking implementation strategies using shared terms and definitions (Perry et al., 2019; Powell et al., 2015). By merely conducting this study, we have already engaged CFIR-ERIC strategies related to identifying barriers and facilitators and involving app users by collecting feedback to capture their knowledge (Perry et al., 2019; Powell et al., 2015). Overall, participants reported experiencing largely positive effects from their meditation practice, with some noting that these positive effects motivated them to continue their practice as they wanted to further alleviate or prevent psychological distress.

Much of what participants reported about their meditation practice using the HMP app aligned with existing literature. In particular, they highlighted facilitators related to the app itself or a standard smartphone (e.g., ability to receive notifications). These included content, aesthetics, customizability, and organizational structure, noting that the app was user-friendly and rewarding, such as progress tracking visuals. Participants also felt it was a strength that the app was grounded in research evidence, as well as found the lessons and meditations to be more validating or supportive than other meditation apps that they have tried—aligned with Shabir and colleagues' finding from a study of lifestyle apps that users appreciated digital interventions that felt "like a friend" (2022). Participants also appeared to perceive reduced barriers to using the app by way of cost, time, and accessibility, particularly relative to a class on meditation (Crosby & Bonnington, 2020). While existing literature has primarily conceptualized participants' schedules and environments as barriers to engaging in a meditation practice (Xu et al., 2021), participants in this study highlighted both barriers and facilitators associated with these factors, including having physical environments that supported meditation by being comfortable and having few distractions.

Congruent with the CFIR-ERIC strategies about increasing adaptability and tailored strategies to support implementation, to further reduce these practical barriers, participants recommended adding shorter meditations that could readily fit into a busy schedule, and more customizable notifications to remind participants to practice at times of day that work

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best for them (Perry et al., 2019; Powell et al., 2015). We recommend that mental health clinicians keep in mind these findings as they are listing meditation apps on their websites or encouraging clients to use these apps. Specifically, we encourage clinicians to discuss client needs and anticipated barriers and facilitators before recommending a particular meditation app. What does the app offer, or lack, that maybe a facilitator, or barrier, to its use by this client?

Accessibility, Usability, and Inclusivity

While participants spoke to practical facilitators and those related to the app itself in ways congruent with existing literature, they also were considerate of accessibility, usability, and inclusivity. In the design and development of apps and other digital tools, accessibility means working to ensure that people with disabilities can access the digital tool when sensory, cognitive, and other impairments may be present (Rush, 2016). Usability means designing and developing a tool that is clear and easy to use, making the user experience more enjoyable. While considerations for usability may disproportionately benefit people with disabilities, accessibility and usability are related, but distinct concepts focusing on inclusivity and enjoyment, respectively (Rush, 2016). Congruent with CFIR-ERIC strategies to promote adaptability and possibly enhance intervention uptake, participants in this study recommended adding features to the HMP app, such as the ability to speed up or slow down the lessons and meditations, as well as include subtitles or scripts (Perry et al., 2019; Powell et al., 2015). These could be considered accessibility features as they may benefit users with hearing or cognitive processing concerns; usability features as they may allow for more versatile engagement with the app which allows different paths for clarity, ease, and enjoyment for users; or both. Clinicians ought to consider and discuss with clients both accessibility and usability in their process of recommending meditation apps. Researchers studying these apps should work to differentiate and relate considerations for accessibility and usability as barriers and facilitators to meditation practice—being aware to not conflate the two.

Participants also had suggestions related to inclusivity. When designing and developing digital tools such as apps, inclusivity refers to efforts to ensure the tool can be effectively used by diverse populations across identities and populations such as disability, tech literacy and skills, education, social class, age, and culture (Rush, 2016). Participants in this study spoke widely to inclusivity such as by recommending the addition of users' stories to the app, particularly ones sensitive to diversity, and creating additional apps or content for particular populations (e.g., K12 students, those with particular mental health conditions). One limitation of CFIR related to inclusivity is that it may situate characteristics of oppressive systems within the Individual Characteristics subdomain (i.e., the individuals involved in implementation), erroneously assigning practice barriers to individuals rather than the intervention. For example, functional impairments related to age—as one participant identified—currently fits best within the Individual Characteristics subdomain construct, *Capability* (i.e., whether an individual has the competence, knowledge, and skills to engage with the intervention), rather than a construct which situates this barrier to practice on the intervention and its developers. This distinction is particularly important for barriers impacting an individual that the individual cannot readily change (e.g., their

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age) or that they could conceivably use the app to improve (e.g., ability to concentrate). While CFIR has a construct within the Outer Setting domain (i.e., the broader context of the implementation setting) called, “Local Attitudes” (i.e., sociocultural values and beliefs supporting implementation), it does not appear useable as a code to describe the experiences of intervention users (Damschroder et al., 2022). We recommend that clinicians familiarize themselves with any apps they plan to recommend to clients with a particular eye for inclusivity. Additionally, researchers studying these apps ought to use a lens of inclusivity to appropriately situate barriers within the individual or intervention.

Facilitators Acquired Through Practice

An additional novel finding from this study points to the importance of attending to the relationship between barriers, facilitators, time, and experience when engaging in a meditation practice longitudinally. When using CFIR (Damschroder et al., 2022), meditation researchers must account for how barriers and facilitators may change with time, including how barriers and facilitators may be acquired by way of meditation practice itself. As has already been suggested by scholars who identified a need to assess changes in CFIR constructs over time (e.g., Fernandez et al., 2018), this may be done by adding relevant questions to surveys deployed to participants throughout the duration of the study. By understanding—with greater complexity—the interplay of barrier, facilitator, time, and experience, researchers may be better able to understand the nuanced and related impacts of these variables among people using meditation apps and how their mental health may be affected. This may require use of the CFIR-ERIC strategies related to developing and implementing quality monitoring processes, advisory boards, and work groups (Perry et al., 2019; Powell et al., 2015). These findings, in turn, may be applied by clinicians working with clients using these apps to address barriers and facilitators changing and emerging over time.

The most common example of this idea related to *concentration*. Namely, is concentration a pre-requisite for building an effective meditation practice, or is concentration a skill built by way of practice? The answer is likely a combination, such that a baseline ability to concentrate may facilitate engagement with a practice, which is met with improvement in concentration by way of meditation, furthering one’s motivation to continue practicing due to experiencing benefits and finding this barrier reduced. Indeed, meta-analyses have found that various aspects of executive control, including those related to concentration and attention, appear modestly improved by meditation (e.g., Verhaeghen, 2020).

Congruent with findings from a recent scoping review (Osborne et al., 2023), for those participants who experienced concentration as a barrier to practice throughout the study, they found that their motivation to practice decreased, perhaps due to the mere challenge of persevering, as well as experiencing little improvement in concentration through practice. One study found that having engaged in practice for longer did not necessarily yield increased benefits for all meditators, namely in concentration and motivation to continue practicing (Lin et al., 2007). Some meditators may have difficulty with concentration or motivation, particularly given these factors may be symptoms of some psychological disorders, including depression and anxiety disorders (American Psychiatric Association,

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2022). Future research in this area should examine what factors facilitate, or are barriers to, participants improving their ability to concentrate and stay motivated in their meditation practice. Clinicians might engage in dialogue with clients around these topics as well. Congruent with the ERIC-CFIR strategy related to developing educational materials, it may be important to emphasize in both marketing materials and within meditation interventions themselves how common it is for beginning meditators (and advanced meditators) to experience difficulties concentrating, and that one need not view this as a failure (Perry et al., 2019; Powell et al., 2015).

Congruent with the body of research on demand characteristics (i.e., participants want to not negatively impact the research; e.g., Nichols & Maner, 2008), participants spoke about the saliency of their research participant role, particularly as a facilitator in continuing their engagement with meditation practice and being a "good" research participant. For these participants, they may have abided by the specific meditation dosage prescribed to their study group but would not have been as adherent if they were not in a research study. Some participants suggested this dynamic was also a barrier to engaging in their practice, as it made meditation feel more forced and less genuine. On the other hand, some participants found study protocols, like daily surveys, to be additive to their meditation practice as these surveys allowed more opportunity for self-reflection. Regardless of participants' perceived impact of their study role saliency, it was apparent that being in this study altered how some participants engaged with their practice. To better understand participants' experiences and how they perceive the impact of the randomized clinical trial environment, it may be important to examine and, ultimately, account for this in studies about naturalistic meditation practice facilitated by meditation apps. Clinicians should also be aware of the impact of their checking in with clients on the use of meditation apps as this may elicit a similar menu of reactions.

Limitations

Our study is not without limitations. First, the clinical trial may impact the breadth of data provided by participants. For example, the intervention period was four weeks and participants were interviewed for the current study shortly following; longer-term user experiences of barriers and facilitators to meditation, such as those impacting practice persistence, were not captured. This study also only utilized the HMP app, which allows for a depth of analysis appropriate for qualitative research but may not translate to users' experiences of other meditation apps. Additionally, participants for the current study were drawn from the clinical trial participant pool, meaning they persisted through the clinical trial and were also willing to engage in a supplemental study exit interview. Although almost all (89 out of 92) participants completed the trial, this participant pool likely did not capture participants who faced insurmountable barriers to practice and did not complete the study or 8 out of 28 participants who did not opt into the exit interview. When possible, future qualitative work should also interview participants who were not able to complete the study.

Second, despite the broad use of CFIR and its diverse application, unforeseen barriers may still emerge during implementation as a result of the complexity and unpredictability of a non-clinical trial, real world. For example, extraneous variables not known or reported

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by participants may have acted as facilitators and barriers to their meditation practice, such as culture, social class, and variable access to technology and tech literacy—concepts not well-captured by CFIR at present (Damschroder et al., 2022). Further, by deductively applying an existing framework to these qualitative data, it is possible that data-derived concepts not reflected in CFIR are not readily expressed in these results. It may be helpful for future qualitative work to apply an inductive lens to capture participants' perspectives not currently reflected in existing implementation models. Lastly, the current study examined the use of the HMP app outside of a health care setting. Thus, we were not able to explore several aspects of CFIR that may be relevant for other implementations of the HMP app, as well as CFIR-ERIC strategies for enhancing implementation, particularly those related to policy (Perry et al., 2019; Powell et al., 2015).

Conclusion

Prior research on the use of meditation apps has identified both barriers and facilitators to their use including psychosocial, practical, and those related to the apps themselves (e.g., Crosby & Bonnington, 2020; Xu et al., 2021). However, few studies have applied the widely used implementation science framework, CFIR, to exploring barriers and facilitators to meditation interventions (Hudson et al., 2020; Lebares et al., 2020; Muñoz Bohorquez et al., 2023). To our knowledge, no studies have explored barriers and facilitators to the use of *self-guided* meditation apps, such as HMP. Using CFIR (Damschroder et al., 2022) and deductive qualitative content analysis (Elo & Kyngäs, 2008), this study explored the implementation of the self-guided HMP app among users with elevated depression, anxiety, or both. From 10 CFIR constructs (Damschroder et al., 2022), we generated four categories from analysis: Practical Facilitators to Developing a Meditation Practice, Motivations for Developing and Maintaining a Meditation Practice, Barriers to Developing a Meditation Practice, and Recommendations for Improving the App. In general, participants felt they experienced positive outcomes from their meditation practice using the HMP app. Some participants experienced these positive outcomes as further motivating to continue engaging in their practice. Additionally, participants suggested enhanced accessibility and usability features within the app, as well as more inclusive content to improve engagement for diverse users. Overall, this study offers valuable insights into the barriers and facilitators of engagement with meditation apps for anxiety and depression. The findings have implications for improving the accessibility and effectiveness of these apps, thereby supporting ongoing efforts to address anxiety and depression as urgent public health challenges. Future research considering how barriers and facilitators may change over time with increased engagement and experience with meditation apps and practice, as well as research examining versions of the HMP app based on participants' feedback, are warranted.

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Appendix A

1. What was your experience with meditation before participating in this study?
    a. IF NONE/MINIMAL RESPONSE TO FIRST QUESTION: What did you think or believe about meditation before participating in this study?
2. As you know, you participated in a study about [SUMMARIZE STUDY]. What was it like to participate in this study?
3. What was it like to use the Healthy Minds Program app?
    a. PROBE: How did you use the app? Walk me through a typical example.
4. As a part of the study, we texted you a lot! How was it to respond to those surveys?
    a. PROBE: What factors supported your ability to respond to those surveys?
    b. PROBE: What factors made it challenging to respond to those surveys?
    c. PROBE: What could we have done to support you in responding to those surveys?
5. As a part of the study, we asked you to practice meditation a certain amount every day. How did that go? (IF MINIMAL RESPONSE I.E. “GOOD,” ELICIT ADDITIONAL DETAIL)
    a. PROBE: What factors supported your ability to stick with your meditation practice?
    b. PROBE: What factors made it challenging to stick with your meditation practice?
    c. PROBE: What could we have done to support your meditation practice more?
6. How, if at all, did your meditation practice in this study affect your life?
    a. PROBE: What were positive effects of the meditation practice?
    b. PROBE: What were negative effects of the meditation practice?

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c. PROBE: (IF INDICATED, “YOU HAVE ALREADY TOUCHED ON THIS A BIT…”) How has the practice affected your wellbeing and mental health?

d. PROBE: How, if at all, did the amount you practiced impact your wellbeing and mental health?

e. PROBE: What other aspects of your practice made a difference?

i. IF UNSURE, PROVIDE EXAMPLES (E.G. SETTING, TIME OF DAY, ETC.)

7. How, if at all, do you plan to incorporate meditation practice into your life?

a. PROBE: How did you come to this decision to (continue/end) your meditation practice?

b. IF THEY PLAN TO CONTINUE: How, if at all, might we support you in continuing your practice?

Concluding Questions: I have just a few more questions before we wrap up.

8. How would you suggest improving the app?

a. PROBE: What would you change about the app?

b. PROBE: What would you keep the same about the app?

9. In addition to everything we have discussed, what else is important for me to know about your participation and meditation practice during this study?

10. Those are all the questions I have! Do you have any questions for me?

Appendix B

1. I’d like to ask you a few questions about how you may have incorporated the practices you are learning in the app into your daily life. We call applying practice in daily life informal practice.

a. How have you brought what you learned from the app into you daily life? (Possible probes: differences in time of day, weekday vs. weekend, during different activities)

b. IF THEY SAY THEY HAVE PRACTICED: How, if at all, did your informal practice in this study affect your life? (Probe: query positive and/or negative aspects)

c. IF THEY SAY THEY HAVE PRACTICED: Can you walk me through a specific example of how you have used these practices in daily life?

d. IF THEY SAY THEY HAVE PRACTICED: When did you find it most natural to use these practices in daily life? (Probe: Did you find yourself engaging in informal practices at certain times of day, during certain activities, using certain practices?)

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e. We are interested in building tools to help encourage people to apply these practices in daily life. What do you think would have been helpful to support you applying these practices in your daily life? (Probe: for example, text message prompts, reminders at certain times of the day, inspiring quotes or practice tips, customizable timing or content)

f. What made it difficult to apply the practices in daily life?

Appendix C

1. Are you Hispanic or Latino? (Hispanic or Latino: A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.)

- 0 = Not Hispanic or Latino
- 1 = Yes, Hispanic or Latino

2. Which of the following best describes your race (circle one or more)?

- 1 = American Indian or Alaska Native
- 2 = Asian
- 3 = Black or African American
- 4 = Native Hawaiian or Other Pacific Islander
- 5 = White
- 6 = Other: _____
- 7 = Prefer not to answer

3. What is your age?____

4. What sex were you assigned at birth, on your birth certificate?

- Female
- Male
- Not listed, please specify (text box)
- Prefer not to answer

5. What is your gender? (check all that apply)

- Man
- Non-Binary
- Woman
- Not listed, please specify (text box)
- Prefer not to answer

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6. Using the following scale please indicate your highest level of education (circle one):

- 1 = Less than seven years of school
- 2 = Seven to nine years of school
- 3 = Ten to 11 years of school (part of high school)
- 4 = High school graduate
- 5 = One to three years of college
- 6 = Four year college graduate (BA, BS, BM)
- 7 = Professional (MA, MS, MD, PhD, LLD, and the like)
- 8 = Not Applicable

7. Are you currently working for pay or profit?

- 0 = No
- 1 = Yes

8. If YES, How many hours per week do you work for pay or profit? _____

9. If NO, Which of the following best describes why you are not working?

- 1 Student
- 2 Looking for work
- 3 Homemaker
- 4 Unable to work
- 5 Other. Please explain:
  _____

10. What is your marital status?

- 1 = married
- 3 = single and never married
- 4 = separated
- 5 = divorced
- 6 = widowed
- 7 = Other
  (SPECIFY:_____)

11. Using the following scale, please indicate your total household income before taxes (circle one).

- 1 = $15,000 or less
- 2 = $15,001 to $20,000

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- 3 = $20,001 to $30,000
- 4 = $30,001 to $40,000
- 5 = $40,001 to $50,000
- 6 = $50,001 to $60,000
- 7 = $60,001 to $70,000
- 8 = $70,001 to $80,000
- 9 = $80,001 to $90,000
- 10 = $90,001 to $100,000
- 11 = $100,001 to $150,000
- 12 = $150,001 to $200,000
- 13 = over $200,000

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Public Significance Statement

The current study applied the Consolidated Framework for Implementation Research to identify barriers and facilitators to people with elevated psychological distress establishing a meditation practice using the Healthy Minds Program meditation app. Four categories were generated reflecting barriers, facilitators, and suggestions for modifications to the app. These results can guide future work refining the Healthy Minds Program and other digital interventions in order to reduce the public health burden associated with depression and anxiety.

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Table 1

Demographic Information of Each Participant

ID	Race/Ethnicity	Gender	Age (years)
1	Latina White	Female	22
2	Non-Latina White	Female	47
3	Non-Latina White	Female	18
4	Asian	Male	21
5	Non-Latino White	Male	69
6	Non-Latina White	Female	25
7	Asian	Female	25
8	Non-Latina White	Female	52
9	Asian	Female	26
10	Black or African American	Female	80
11	Non-Latina White	Female	40
12	Non-Latina White	Female	23
13	Asian	Female	21
14	American Indian	Female	54
15	Asian	Female	27
16	Non-Latino White	Male	19
17	Non-Latina White	Female	62
18	Non-Latina White	Female	30
19	Non-Latina White	Female	32
20	Non-Latina White	Female	26

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Table 2

Study Categories and Consolidated Framework for Implementation Research (CFIR) Constructs

Study Categories	CFIR Constructs	Study Definition*	Example
Practical Facilitators to Developing a Meditation Practice	Design	The app is well-designed and packaged, including how it is assembled, bundled, and presented.	"…the colors of the background [is] really relaxing. It's like the blues and the purples."
	Source	The group that developed the app (i.e., the Center for Healthy Minds and associated staff) is reputable, credible, and trustable.	"…obviously, this is very curated material based on research and empirical data. So, I understand that there's probably very specific reasons why these things exist."
	Relative Advantage	The app is perceived to be better than other available apps or other routes for developing a meditation practice.	"I'm a big fan of apps and this was one of the better laid-out apps that I've used, so kudos!"
	Cost	The app purchase and operating costs are affordable for participants (i.e., free of cost).	"Is the app something that I'm still able to use, or is it something you pay for?"
	Opportunity	The participant has the availability, scope, and power to use the app.	"…I would usually [meditate] at the end of my night to have a space where I could decompress…"
	Capability	The participant has the competence, knowledge, or skills to use the app.	"I know that some people use [meditation] spiritually… it helps them connect with different aspects of their life. That was what I had known about [meditation]."
Motivations for Developing and Maintaining a Meditation Practice	Evidence Base	The app has robust evidence—defined by participants' own experience—supporting its effectiveness.	"…over time, seeing that I generally felt a lot calmer after I would do the meditations and feel like my mind was freed up… that became very motivating."
	Need	The participant has deficits related to survival, well-being, or personal fulfillment, which will be addressed by use of the app.	"My anxiety gets bad at night (…) [meditation] was helpful in calming my craziness and I found I was sleeping better."
	Motivation	The participant is committed to using the app.	"…my dad is someone who struggles with depression, my family has a lot of anxiety (…) I don't want to get to that place (…) that to me is a motivating factor [to meditate]…"
Barriers to Developing a Meditation Practice	Opportunity	The participant lacks the availability, scope, and power to use the app.	"…I found that [meditating] was harder because my family was around. I don't think it's easy to do when you're not alone in a quiet environment."
	Capability	The participant lacks the competence, knowledge, or skills to use the app.	"…I think [if I was] a little younger, I could focus more. (…) My focusing is not the greatest."
Recommendations for Improving the App	Adaptability	The app can be modified, tailored, or refined to meet the context and needs of a group or community of people.	"…what I'd like to recommend is (…) adapting this specifically to patients or people with drug addiction of alcohol use disorder."

*Adapted with frequent retention of direct phrasing from Damschroder et al.(2022).

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Table 3

Summary of Study Takeaways

Study Categories	**Takeaways**	
	Innovation (i.e., HMP app)	***Individual (i.e., users, participants)***
Practical Facilitators to Developing a Meditation Practice	• Free-to-use • User-friendly (e.g., tracking visuals, step-by-step modules, “next” button) • Aesthetically pleasing (e.g., layout, colors, font) • Educational and meditation audio • Encouraging and validating • Explicitly research-based • Customizable (e.g., narrators, seated or active)	• Prior knowledge of meditation • Environment (e.g., alone, comfortable) • Schedule (flexibility or routine)
Motivations for Developing and Maintaining a Meditation Practice	• Ease of access by phone • Brevity of meditations • Improvement begetted motivation	• Alleviate/prevent mental health concerns • Curiosity • Checking it off the list • Responsibility as a research participant
Barriers to Developing a Meditation Practice	N/A	• Concentration • Lack of motivation • Schedule (e.g., variable, busy) • Work, school, family responsibilities
Recommendations for Improving the App	• Shorter meditation options • Faster cycling between module topics • Customizable goals and notifications • More stories • Greater diversity in app content • More types of meditations (e.g., “different schools of Buddhism”) • Adaptations for specific populations • Accessibility features (e.g., adjust speed, transcripts)	N/A