# Understanding the Implementation of Informal Meditation Practice in a Smartphone-Based Intervention: A Qualitative Analysis

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**Abstract**

**Objectives:** Informal practice (i.e., brief meditation practices incorporated spontaneously into daily activities) may be important for increasing the efficacy and accessibility of meditation-based interventions (MedBIs). However, the facilitators and barriers to engaging in informal practice are largely unknown. The current study aimed to investigate factors associated with the implementation of informal practice. **Method:** Participants were drawn from a randomized trial testing the effects of 5- versus 15-min daily meditation practice in a 4-week smartphone-delivered meditation training. Qualitative interviews on informal practice were conducted with 17 participants (mean age: 37.12 years; 82.35% female; 52.94% non-Latinx White) following the intervention. Given that prior knowledge on this topic is limited, inductive content analysis was utilized to characterize participants' experiences in relation to implementing informal practice. **Results:** Four overarching categories emerged from the data, namely (a) reported benefits of informal practice, (b) integration of informal practice, (c) perceived barriers to informal practice, and (d) recommended facilitators of informal practice. **Conclusion:** This study underscores the importance of addressing barriers and facilitators (e.g., providing personalized app features, reminders, social support, and repeating intervention content) to encourage individuals' informal practice. Findings provide suggestions for methods to increase engagement in informal practice, which may, in turn, increase the accessibility and effectiveness of MedBIs. **Preregistration:** The larger trial from which the qualitative interview participants were drawn was preregistered through clinicaltrials.gov (NCT05229406) and the Open Science Framework (https://osf.io/fszvj/?view_only=039b14ccbf8848bd99808c983070b635). The qualitative analyses reported here were not preregistered.

*Keywords*: Meditation; mindfulness; loving-kindness; compassion; informal practice; implementation

# Understanding the Implementation of Informal Meditation Practice in a Smartphone-Based Intervention: A Qualitative Analysis

Meditation is a family of contemplative practices involving attention and emotional regulation training (Lutz et al., 2008). Over the past several decades, there has been a dramatic increase in scientific research on meditation (Baminiwatta & Solangaarachchi, 2021; Zhang et al., 2020). Meditation has also piqued the interest of the general public; according to the National Health Interview Study, approximately 20% of American adults engaged in meditation practice in the year 2017 (National Center for Health Statistics, 2018). Meditation-based interventions (MedBIs) have the potential to improve psychological symptoms and enhance well-being (Galante et al., 2014; Goldberg, Riordan, et al., 2022; Xie et al., 2022). With advances in smartphone technology, MedBIs delivered by smartphone apps are widely used (Lam, Xie, et al., 2023; Wasil et al., 2020). App-delivered MedBIs may effectively enhance mental health and increase the accessibility and personalization of MedBIs (Gál et al., 2021; Goldberg, Lam, et al., 2022; Webb, Hirshberg, et al., 2022; Webb, Swords, et al., 2022).

Traditional standardized MedBIs, such as Mindfulness-Based Stress Reduction (Kabat-Zinn, 2013) and Mindfulness-Based Cognitive Therapy (Segal et al., 2013), typically encourage participants to engage in both formal and informal meditation practice. In formal practice, participants traditionally set aside time during the day to engage in meditation outside of the context of daily activities (e.g., sitting still and being mindful of the sensations of breathing). In contrast, informal practice involves the integration of meditation techniques in the midst of daily activities and occurs spontaneously and without explicit planning (e.g., being mindful of sensations of the body while walking throughout the day; Kabat-Zinn, 1990). Unlike formal practice which may be guided (e.g., via an audio recording), informal practice is typically not

guided and may be very brief (e.g., moments of attending to sensations of the body while walking). The recent rise of app-delivered MedBIs allows the possibility of delivering formal meditation practices in novel ways. For example, the Healthy Minds Program (HMP) app (Dahl et al., 2020; Goldberg et al., 2020; Hirshberg et al., 2022), which is the focus of the current study, includes "active" practices. Within HMP, active practice is considered a type of formal practice that is delivered through audio recordings with step-by-step instructions, similar to formal sitting or walking meditation, but with the intention of being done during daily activities such as walking or light housework. While these activities may serve functional purposes (e.g., folding laundry or walking to a destination), the primary objective of active practice is to engage in meditation. Active practice shares similarities with formal sitting or walking practice in traditional MedBIs, as it involves intentionally allocating a specific period of time for meditation. However, it also shares some similarity to informal practice since it involves practicing while engaging in daily routines. For the purposes of the current study, we follow the way active practices are conceptualized within HMP and consider them a type of formal practice that is distinct from informal practice.

Formal practice has been studied more thoroughly than informal practice. A recent meta-analysis found that a higher amount of formal practice was associated with better outcomes in Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy (Parsons et al., 2017). However, finding time for formal practice has been reported as a barrier to engaging in MedBIs (Bamber & Schneider, 2022; Engbretson et al., 2020; Sears et al., 2011). In contrast, informal practice has the potential to decrease burden and increase engagement in MedBIs as participants do not need to dedicate time exclusively to informal practice. Moreover, informal practice may help individuals cope with real-life situations (e.g., using loving-kindness and

compassion techniques to cope with interpersonal challenges) as it can be directly applied in the midst of daily activities.

Empirical evidence suggests that informal practice may be linked with improved outcomes in the context of MedBIs. Fredrickson et al. (2019) found that daily informal practice predicted higher same-day positive emotions and perceived social integration during both 6-week mindfulness and loving-kindness training. Manigault et al. (2021) demonstrated that daily informal practice during mindfulness training attenuated increases in perceived stress and buffered against the decreases in successful stress coping from pre- to post-intervention. In a 2-week, app-delivered loving-kindness and compassion training, Xie et al. (2023) found that higher current-day informal practice predicted decreased next-day psychological distress but not next-day loneliness. In contrast, cross-lagged associations from psychological distress or loneliness to informal practice were non-significant.

Experimental studies also support the benefits of informal practice. A randomized controlled trial showed that participants who washed dishes after reading a mindfulness dishwashing passage demonstrated improved state mindfulness and affect compared with those who washed dishes after reading a descriptive dishwashing message (Hanley et al., 2015). In addition, mindfulness training programs consisting of informal practice within and between sessions significantly improved dispositional mindfulness, self-compassion, psychological distress, and life satisfaction relative to waitlist controls (Hindman et al., 2015; Shankland et al., 2021). Given the potential benefits of informal practice and the challenges of engaging in formal practice for many individuals, informal practice may be important for increasing the efficacy and accessibility of MedBIs.

Given the potential value of informal practice, there is a need to identify factors that facilitate it as well as barriers participants may face to engaging in informal practice. Addressing these implementation factors may help facilitate the integration of meditation practices into people's daily lives (Wiltsey Stirman & Beidas, 2020). An increasing number of studies have begun to investigate implementation factors associated with meditation (e.g., Hunt et al., 2020; Jiwani et al., 2022; Lam, Riordan, et al., 2023), particularly within the context of app-delivered MedBIs (Banerjee et al., 2017; Clarke & Draper, 2020; Laurie & Blandford, 2016; Strauss et al., 2021; Xu et al., 2021). Some practical challenges to engaging in MedBIs and formal practice specifically include difficulty finding time (Moore & Martin, 2015; Strauss et al., 2021), the perceived burden of formal practice itself (e.g., extended periods of formal practice; Banerjee et al., 2017; Fatkin et al., 2021), difficulty fitting MBI class meetings in with work schedules, and lack of a private physical space for practice (Eddy et al., 2021; Xu et al., 2021). Some barriers have been more related to the individual, including challenges with breaking mental habits (Banerjee et al., 2017), heightened emotional distress (Laurie & Blandford, 2016), and low motivation for formal practice (Xu et al., 2021). Still other barriers have been related to characteristics of the interventions themselves, including dislike of intervention design or features (Clarke & Draper, 2020; Laurie & Blandford, 2016) and concerns about cost (Xu et al., 2021).

Studies have also identified facilitators for engaging in MedBIs and formal practice. Some facilitators related to personal characteristics include participants' motivation for improving their mental health and well-being (Banerjee et al., 2017; Clarke & Draper, 2020), being able to incorporate meditation into daily routines (Sullivan et al., 2023), and perceiving meditation as valuable (Moore & Martin, 2015; Yadav et al., 2022). Some facilitators related to

intervention characteristics include providing a rationale for a given MBI or formal practice (Banerjee et al., 2017) and specific intervention features such as repetition of content, self-paced learning, visual aids, relatable content, and formal practices with varying durations (Laurie & Blandford, 2016; Xu et al., 2021; Yadav et al., 2022).

The existing literature provides some insight into ways that MedBIs and formal practice can be made more accessible. However, barriers and facilitators specific to informal practice have not been thoroughly investigated. Again, given the potential for informal practice to augment the accessibility and efficacy of MedBIs, it is worthwhile studying this intervention element specifically. Qualitative methods may be especially beneficial for this task. Qualitative methods allow in-depth exploration of the contexts and process of implementation by gathering detailed information about participants' experiences and perspectives (Hamilton & Finley, 2019; QUALRIS Team, 2018). Inductive content analysis, a widely used qualitative method, involves systematically deriving categories and patterns directly from the data, without relying on predetermined frameworks or assumptions (Elo & Kyngäs, 2008). It is particularly advantageous in investigating underexplored fields such as the implementation of informal practice, as it allows the formation of conceptual maps that can contribute to a more nuanced understanding of emerging fields (Elo & Kyngäs, 2008).

The current study aimed to investigate barriers and facilitators associated with the implementation of informal practice. To achieve this aim, we conducted qualitative interviews with participants following a 4-week smartphone-delivered meditation training (HMP app; Dahl et al., 2020; Goldberg et al., 2020; Hirshberg et al., 2022). Participants were drawn from a randomized trial testing the effects of lower versus higher doses of daily meditation practice (i.e., 5- vs. 15-min per day). Given limited current understanding of the implementation of informal

practice, we utilized inductive content analysis (Elo & Kyngäs, 2008) to characterize participants' experiences in relation to implementing informal practice.

## Method

The current study utilized an inductive content analysis approach (Elo & Kyngäs, 2008) to describe participants' experiences related to implementing informal practice during a 4-week smartphone-delivered meditation intervention. Participants were drawn from a randomized trial testing the effects of lower versus higher doses of daily meditation practice (i.e., 5- vs. 15-min per day) delivered via the HMP app (Dahl et al., 2020; Goldberg et al., 2020; Hirshberg et al., 2022) . In the randomized trial, 92 participants with elevated symptoms of depression, anxiety, or both (Patient-Reported Outcomes Monitoring System [PROMIS] T-scores > 55; Choi et al., 2014; Schalet et al., 2014) were randomly assigned to use the HMP app 5 or 15 minutes per day for four weeks. The trial aimed to test the feasibility, acceptability, and effectiveness of the HMP app as an intervention for reducing psychological distress; the feasibility of randomly assigning participants to different meditation practice dosages; and the dose-response relationship. Participants completed self-report questionnaires at the beginning and end of the study and were asked to complete ecological momentary assessments (EMAs) via short surveys delivered to their smartphones four times daily during the study period. The trial was approved by the Institutional Review Board at the University of Wisconsin – Madison (2019-1578) and was preregistered at clinicaltrials.gov (NCT05229406) the Open Science Framework (https://osf.io/fszvj/?view_only=039b14ccbf8848bd99808c983070b635). Qualitative analyses conducted in the current study were exploratory and not preregistered.

### Participants and Procedure

Participants in the trial were meditation-naïve adults with clinically elevated depression, anxiety, or both (Patient-Reported Outcomes Monitoring System [PROMIS] T-scores > 55; Choi et al., 2014; Schalet et al., 2014). Exclusion criteria included prior meditation retreat experience, weekly meditation practice for over one year or daily practice within the previous six months, or previous practice under the instruction of a meditation teacher outside of an introductory course. Individuals with severe depression (PROMIS Depression T-score > 70; Kroenke et al., 2020) were also excluded as were individuals at risk for alcohol use disorder based on the Alcohol Use Disorder Identification Test (Aalto et al., 2009).

At the end of the 4-week intervention period, participants were invited via email to take part in an exit interview about their meditation practice and experience of the study procedures. Aiming to gather a wide range of perspectives from participants with varying racial/ethnic identities and app engagement, we oversampled racial/ethnic minority participants and invited participants with a range of levels of engagement with the HMP app for the interviews. Twenty-one participants expressed interest and 20 completed interviews. Questions about informal practice were added to the interview protocol after three interviews were already completed; as such, 17 participant interviews were analyzed for the current study. One interviewer (RLD) conducted all interviews. The interviewer was a qualitative researcher who was familiar with the HMP app and engaged in occasional personal meditation practice particularly to manage stress and sleep. The interviews had a duration of 23 to 39 minutes; all interviews were conducted via Zoom such that participants could join the interview from a location of their choice. All interviews were recorded using the Zoom recording feature. Only the portions of each interview asking about informal practice were included in the current analysis. The demographics of the 17 participants were as follows: 37.12 years old on average (standard deviation = 19.76, range [18,

80]); 82.35% female, 17.65% male; 52.94% non-Latinx White, 29.41% Asian, 5.88% Latinx White, 5.88% Black or African American, 5.88% American Indian. The demographic information of the 17 participants is provided in Table 1.

**Intervention**

The intervention was a 4-week meditation training provided by the freely available HMP meditation app. The HMP app is designed to cultivate psychological well-being by building skills across four domains: Awareness, Connection, Insight, and Purpose (Dahl et al., 2020; Goldberg et al., 2020; Hirshberg et al., 2022). The Awareness module trains mindfulness and meta-awareness skills; the Connection module is designed to cultivate appreciation, kindness, and compassion; the Insight module helps users to develop insight into the ways in which thoughts and emotions shape experience of reality; and the Purpose module helps to clarify values and meaning in life (Dahl et al., 2020). All modules provide guided practices for both sitting meditation and meditation during daily activities (i.e., active practices), as well as psychoeducation on the rationale and scientific basis of meditation practice. Participants could choose the "active" or "sitting" option for any formal guided practices. The app also encourages users to apply meditation skills informally in daily life (i.e., informal practice). Specifically, at the conclusion of formal guided practices, instruction includes "tips" and encouragement (e.g., "You can practice this skill in everyday life by giving your full attention to whoever you are with and whatever you are doing") for applying these techniques in daily life. The app also includes a daily reminder notification (e.g., "Take a moment to pause today. This is your Healthy Minds well-being reminder") which may encourage informal practice.

**Measures**

The full, semi-structured interview protocol contained nine questions (e.g., "How, if at all, did your meditation practice in this study affect your life?") with subsequent probes detailed throughout the protocol (e.g., "What were positive effects of the meditation practice?"). As noted above, for the current study, only participant responses to the question about informal practice and its probes were included (see Supplementary Table S1). During the interviews, the interviewer would probe for more detail as necessary using both probes included in the interview protocol, as well as those generated in response to participant statements. Interviews were first automatically transcribed using the Zoom audio transcription feature, then edited for accuracy by two undergraduate research assistants, the first author (QX), and/or the interviewer (RLD).

**Data Analyses**

Inductive content analysis was used to characterize implementation factors associated with informal practice given that prior knowledge on this topic was limited (Elo & Kyngäs, 2008). Inductive content analysis views meaning as derived from multiple realities that are being constructed by both the interviewees and investigators (Erlandson et al., 1993). With a content analytic approach, we "identify themes and patterns of the study data" through a subjective interpretation process (Hsieh & Shannon, 2005, p. 1278). Codes, categories, or themes were derived directly from the interview data instead of prior theoretical frameworks.

The research team consisted of nine members: a PhD student in counseling psychology who studies meditation, technology-based interventions, and implementation science (QX), a qualitative researcher and PhD candidate in counseling psychology whose work is primarily focused in another area (reproductive justice; RLD), a PhD candidate in counseling psychology who is a contemplative science researcher with qualitative experience acquired through qualitative classes (e.g., grounded theory; SUL), a research program coordinator with experience

supporting diverse data collection efforts (CF), a contemplative scientist who studies meditation (CJD), an implementation scientist who studies the implementation and dissemination of technology-based interventions (AQ), a methodologist who studies adaptive interventions and technology-based interventions (INS), a psychologist and neuroscientist who studies emotion and contemplative interventions (RJD), and the principal investigator – a psychologist who studies psychotherapy, meditation, and technology-based interventions (SBG).

Content analysis consisted of three phases: preparation, organizing, and reporting (Elo & Kyngäs, 2008). In the preparation phase, the unit of analysis was selected as participant responses to interview protocol questions about informal practice. Only manifest content was analyzed (i.e., what participants actually said, rather than their underlying meaning; Elo & Kyngäs, 2008). The coders (QX and RLD) first familiarized themselves with the data through numerous read-throughs of all transcripts. For the purposes of investigator triangulation (i.e., the use of more than one researcher to mitigate bias), the first (QX) and second (RLD) authors also acted as coders (Denzin, 2015; Fusch et al., 2018). NVivo 12 (QSR International Pty Ltd, 2022) software was used to support data analysis.

During these read-throughs, the coders began the organizing phase by engaging in open coding - “notes and headings are written in the text while reading it (…) to describe all aspects of the content” (Elo & Kyngäs, 2008, p. 109). In other words, the coders created initial notes and headings without preconceived notions while reading the transcripts. The coders then collected these notes and headings and collapsed them into higher-order groups, developing the codebook (Elo & Kyngäs, 2008). To enhance credibility (Lincoln & Guba, 1986), the initial codebook was compared back to the data and adjusted as needed. The transcripts were coded independently by the coders (QX and RLD); any disagreement was discussed and clarified, and code names and

definitions were updated in the codebook (Lincoln & Guba, 1986). No new codes were identified in this process, indicating that inductive thematic saturation was reached (Saunders et al., 2018). This suggested that the inclusion of 17 participants was sufficient to capture the depth and breadth of participants' experiences in the current study.

Finally, the coders engaged in abstraction (i.e., "formulating a general description of the research topic through generating categories") and prepared for reporting the analytic process and results (Elo & Kyngäs, 2008, p. 111).

## Results

Four overarching categories emerged from the data: reported benefits of informal practice, integration of informal practice, perceived barriers to informal practice, and recommended facilitators of informal practice. These categories are described below. See Table 2 for the content of the four overarching categories and corresponding sample quotes.

### Reported Benefits of Informal Practice

The first category, Reported Benefits of Informal Practice, captured the positive outcomes that participants reported as resulting from their informal practice. Participants reported a range of benefits including greater perspective and awareness of themselves and others, especially within interpersonal relationships; improved emotional and mental health, including more hope for the future; and more focus and ability to complete tasks.

Participants who utilized informal practice in response to specific stressful situations appeared to benefit from the practice: "I would try to do one of the breathing things and I think that that did help me turn my brain off" (P #8). Some participants reported experiencing numerous benefits, such as one participant (P #4) who described positive changes after a period of low motivation and isolation:

> *"...I couldn't get my daily tasks done. Housekeeping tasks, or even contacting friends, family – stuff like that. I was losing my handle on that then, after getting into the habit of [informal practice], my mental wellbeing was just better. I was able to do the necessary tasks. It just made me better prepared..."*

Other participants reported experiencing global benefits, across various aspects of their lives. One participant put it this way (P #3): "I think [informal practice] made me think about things in different ways. (…) To like think about [things] in a new way."

Reported benefits were not always clearly distinguished from the informal practice skills that participants practiced. In other words, the *practice* of informal practice skills themselves may have been inherently beneficial—as they are being practiced—even in the absence of positive outcomes *resulting* from informal practice—after practice has ceased. For example, several participants noted that engaging in informal practice involved the skills of cultivating greater awareness of themselves and their environments. One participant (P #5) described slowing down when their former tendency may have been to think quickly or excessively:

> *"If anything, [informal practice] slows down your thinking. I think too many of us think too much (...) The way you think affects the way you react. If anything, [informal practice] is slowing down that process in your mind..."*

A couple participants explicitly noted that engaging in informal practice was beneficial *only* when skills were in use, but that their overall wellbeing was not substantially impacted. For example, one participant (P #6) briefly summarized the skill used in their informal practice (i.e., being more present and aware, expressing gratitude), but qualified that these beneficial skills had little impact on their life:

> *"I think generally being more present is preferable. And having a sense of how I'm*

*feeling is also good because then I can take action or, like, 'I did this today and I'm feeling happy.' That's a good thing to notice. But I don't feel like it's had any kind of huge, significant impact on my life."*

**Integration of Informal Practice**

The second category, Integrating Informal Practice, captured *when* and *how* participants reported utilizing informal practice in their lives. Many participants described effortful engagement in informal practice in response to anticipated or current situations (e.g., before stressful work events, when driving in traffic, when feeling busy or stressed, when taking a walk). Informal practice was characterized by using specific tools (e.g., breathing exercises), shifting one's thinking (e.g., putting oneself in others' shoes), or working to be more present in the moment (e.g., slowing down).

Participants appeared to use different skills depending on their goal for engaging in informal practice, such as using a specific exercise to manage stress or increase productivity at work or paying attention to one's surroundings to enhance wellbeing while taking a walk. For example, one participant (P #8) described both working to be present in the moment during their lunch breaks and using specific exercises to manage anxiety before work meetings:

*"...before this, I would (...) study, eat lunch at my desk, and do five other things while I'm eating lunch and, [now, I am] just going down to the break room and taking time (...) and really just focusing on one thing."*

*"...setting an alarm for a time [to engage in informal practice] (...) and especially if it's a meeting that I know could be kind of stressful or cause some anxiety."*

Several participants emphasized using informal practice to address challenges in their interpersonal relationships—such as shifting their thinking to better understand why another

driver may have cut them off on the road or extending gratitude to friends via text. One participant (P #16) endeavored to be more engaged with their friends when they spent time together: "If I'm with friends, like, thinking about some of those [meditation practice] ideas like presence and awareness."

A few participants denied engaging in informal practice at all or engaged with it only while completing EMA surveys of the study. For some, it seemed that filling out the EMA surveys was perceived as a kind of informal practice. As one participant (P #9) put it: "I would only think and do things while I'm doing the [formal, app-based] practice or taking the survey. (…) with the surveys, I found them to be quite often, so I didn't have to [practice] that much outside of taking the surveys."

On the other hand, some participants appeared less intentional in their informal practice, instead noticing that their skills would be naturally or automatically used throughout the course of their day, rather than in response to certain situations or conditions. In other words, rather than intentionally selecting and using a skill acquired through the HMP app, these participants felt that they were now broadly approaching the circumstances of their lives differently. For example, "...I haven't intentionally been [engaging in informal practice], but I have noticed that it kinda comes to me, to think about situations differently. And then how I'm reacting to situations – what am I actually trying to facilitate through this interaction?" (P #14).

**Perceived Barriers to Informal Practice**

The third category, Perceived Barriers to Informal Practice, captured participants' reported barriers—or their perceptions of barriers others may face—to utilizing informal practice. A few participants reported that their engagement in informal practice felt "easy" and without barriers. For others, barriers included their daily schedule and the fast pace of life—

which felt antithetical to their ability to mindfully slow down—or having a "bad day," which disrupted their ability to engage in informal practice. For example, one participant (P #1) said this of barriers to informal practice, "Just having an awful day and not being able to... think. Just those days where your mind doesn't really focus (…) not really reflecting."

Some participants described barriers related to how meditation skills were taught through the app, which they reported did not set them up for success in utilizing informal practice. For example, one participant noted that some of the lessons in the app felt less relevant for them, which led to them paying less attention and, ultimately, being less able to utilize those skills in informal practice. On the other hand, some participants felt uncertain of how to practice informally given that they learned these skills alone with only the help of a low-intensity app format. One participant (P #11) put it this way: "[The lessons in the app] are not repetitive enough, or maybe I just don't pick up on things fast enough in just 5 minutes. I didn't think about it the next day."

A handful of participants described motivation as their primary barrier to informal practice or thought that others may experience a lack of motivation as a barrier. For example, when asked what would have been helpful to support their engagement in informal practice, one participant (P #11) simply responded, "If I was motivated to do so." Many of these participants suggested that the app was excellent, but would not be beneficial for someone who was simply not motivated to build their meditation practice. As one participant (P #17) put it:

> *"I think the tools were all there. It was up to me to go use the tools. (...) Nobody's holding my hand. I just have to think about what the benefit is. It was a great benefit, which makes me want to go back to it."*

Indeed, one participant likened the availability of the app to the availability of a gym for someone who is not motivated to exercise.

**Recommended Facilitators of Informal Practice**

The fourth and final category, Recommended Facilitators of Informal Practice, captured participants' recommendations for encouraging future study participants to engage in informal practice. Recommendations ranged from the addition or adjustment of existing content or processes in the app, to significant changes made to the study protocol.

Many participants recommended the use of notifications or text reminders to "prompt" study participants to engage in informal practice. For example, one participant (P #5) recommended using specific language in app notifications to encourage informal practice: "How could your mindfulness techniques be improved at this very moment?" Some participants provided additional detail about how these notifications or reminders might look (e.g., personalized and written by the study participants themselves) and how they might be deployed (e.g., at different or random times of day). Others recommended that the reminders evoke specific content learned in the app the day before or include a rationale for engaging in informal practice.

In addition to notifications or reminders, participants suggested a range of other changes to the content or process of the app, such as adjusting how the lessons were presented, or providing a journal or habit-tracker within the app so that participants could document their practice. Several participants expressed a need for greater support in taking what they learned from the app into informal practice, such as through examples of how this might look. One (P #2) said,

*"...some tips at the end [of the lesson or guided meditation in the app] of things to keep in mind. If those were easier to reference, if you could just pull up those tips in a different part of the app, that might be helpful."*

Along with recommendations for how the app might be updated to encourage informal practice, participants also recommended changes to the study protocol. For example, some participants indicated a preference for support from others. Several participants expressed a preference for speaking aloud or working with others (e.g., learning meditation skills in a group setting), rather than "alone" with an app. Some of these participants noted that they would have specifically benefitted from working with a therapist throughout the study as a therapist may have helped them better integrate their informal practice or connect meditation to their own emotions. One participant (P #9) put it this way, noting that the introduction of a therapist might be too far off from the study purpose:

*"...this isn't really the point of the study but, I'm a talker, so some of the questions on the end-of-study survey saying like, 'Do you feel like a counselor or a therapist would be more effective?' Probably, yes, 'cause I'm a talker, so yes! And I know that's not the point of creating an app (...) but..."*

## Discussion

The current study sought to characterize participants' experiences in relation to implementation factors associated with informal practice following a 4-week smartphone-delivered meditation intervention (i.e., HMP app). Analysis of qualitative interviews indicated four overarching categories: reported benefits of informal practice, integration of informal practice, perceived barriers to informal practice, and recommended facilitators of informal

practice. Here we explore the ways in which these categories relate to prior and future research on the topic of informal practice.

In relation to the first category, there was some evidence that participants experienced both intra- and inter-personal benefits of informal practice. This finding is in line with previous experimental (Hanley et al., 2015; Hindman et al., 2015; Shankland et al., 2021) and cross-lagged (Xie et al., 2023) evidence supporting the possibility of beneficial effect of informal practice. The potential benefits of informal practice, along with its potential to reduce burden and enhance engagement in MedBIs, support its importance in increasing the accessibility of MedBIs.

We found that participants exhibited varying levels of engagement in informal practice. Participants indicated effortful use of various types of informal practices (e.g., breathing exercises, paying attention to one's surroundings) and different ways of integrating informal practice into their daily lives (e.g., when feeling busy or stressed, when taking a walk). Given this variability, it may be helpful for future MedBIs to personalize the ways participants are encouraged to engage in informal practice. Just-in-time adaptive interventions (JITAIs) are a type of intervention that is designed to provide the right type and amount of support to individuals based on their internal and contextual states that fluctuate over time in daily lives (Nahum-Shani et al., 2018). Some randomized controlled trials suggest that JITAIs were more effective in improving psychological distress compared to interventions without tailoring contents based on individuals' momentary needs (Levin et al., 2019; Smyth & Heron, 2016). Given the individualized nature of engaging in informal practice among participants and potential benefits of JITAIs, MedBIs may leverage JITAIs to prompt appropriate types and amount of informal practice according to participants' real-time needs to facilitate the adoption

of informal practice. For example, MedBIs may foster informal loving-kindness and compassion practices in situations where individuals experience a lack of interpersonal connection, and they may encourage informal mindfulness practices when individuals are dealing with rumination.

Participants highlighted practical, psychosocial, and app-related barriers and facilitators to engaging in informal practice. In terms of practical barriers, busy schedules were reported as a challenge to engaging in informal practice. This aligns with previous studies highlighting busy schedules and difficulty in finding time (e.g., Laurie & Blandford, 2016; Moore & Martin, 2015; Strauss et al., 2021) as common barriers for participating in MedBIs generally. Informal practice requires participants to remember and engage with skills during daily activities, potentially deviating from their pre-existing habits (e.g., mindlessness in daily activities). This requirement may naturally be challenging, both for very busy individuals as well as for meditation-naive participants who are in the initial stages of integrating meditation practice into their daily routines. Indeed, the struggle to break away from old habits like mindlessness has been identified by previous studies as a barrier to engaging in MedBIs and formal practice (Banerjee et al., 2017). It would be valuable for future studies to delve into the factors contributing to participants' difficulty in engaging in informal practice in the context of busy schedules, and subsequently, integrate these insights into intervention strategies. If forgetting to practice is found to be the key factor, MedBIs could be enhanced by delivering timely reminders throughout the day, reminding participants of engaging in informal practice.

Motivation emerged as both a key psychosocial barrier and facilitator. Some participants suggested that people need intrinsic motivation for informal practice and that, lacking such motivation, additional tools may not enhance their capacity to engage in informal practice. This finding is consistent with Xu et al. (2021), who showed that lack of motivation was a perceived

barrier to engaging in MedBIs. Self-Determination Theory posits that a sense of autonomy, competence, and relatedness contribute to intrinsic motivation (Deci & Ryan, 2012). Echoing Self-Determination Theory, participants in the current study suggested support from others (e.g., mental health providers and other participants) may facilitate engagement in informal practice. In addition, some participants indicated that psychological distress (e.g., "having an awful day") made it challenging for them to engage in informal practice. One potential explanation is that participants with psychological distress (e.g., high anxiety and depression) may experience difficulties in concentration and lack of energy (American Psychiatric Association, 2013; Forster et al., 2015; Keller et al., 2019), which may make them feel a lack of competence engaging in informal practice. Based on Self-Determination Theory and our findings, future MedBIs may cultivate individuals' intrinsic motivation for informal practice by supporting autonomy (e.g., encouraging participants to select and engage in types of informal practice that are relevant to them), promoting competence (e.g., promoting easy-to-implement informal practice in daily routines such as taking a few mindful breaths right after waking up in the morning), and fostering a sense of relatedness (e.g., connecting with other participants or mental health providers).

In terms of app-related barriers and facilitators, some participants described that the design and content of the HMP app (e.g., app content not relevant and not repetitive enough) made it challenging for them to learn meditation skills which led to not being able to apply these in daily life. Consistent with these findings, previous studies have found that dislike of intervention design impaired participants' engagement in MedBIs (Clarke & Draper, 2020; Laurie & Blandford, 2016; Xu et al., 2021). Correspondingly, participants in the current and previous studies suggested flexibility and personalization for promoting engagement in informal

practice and MedBIs in general (Xu et al., 2021; Yadav et al., 2022). Participants in the current study also suggested that repetition and more opportunities to build informal practice skills (e.g., receiving reminders about specific content learned in the app the day before) would have facilitated their informal practice. The preferences for flexibility and personalization, as well as repetition of intervention content, may be related to needs of autonomy and competence (Deci & Ryan, 2012). Given these findings, MedBIs in the future may consider personalizing and repeating meditation practices (e.g., through sending personalized reminders, self-paced learning, repeating intervention content) to help participants develop general meditation skills and informal practice.

In summary**,** the current study reveals participants' experiences of informal practice implementation following a 4-week smartphone-delivered meditation intervention. The study underscores the importance of personalized app features, reminders, repeating intervention content, and social support to facilitate individuals' informal practice. Findings may provide insight into how to increase engagement in informal practice, which may, in turn, increase the accessibility and effectiveness of MedBIs.

**Limitations and Future Research**

The current study has several limitations. First, given the limited prior empirical work exploring the implementation of informal practice, we conducted qualitative interviews and inductive content analysis without relying on predetermined frameworks or assumptions. While this approach allowed for a more open exploration of participant experiences, we may have missed detecting relevant factors that could be identified with established implementation science frameworks, such as the Consolidated Framework for Implementation Research (CFIR; Damschroder et al., 2022). In future studies, a more thorough exploration of informal practice

implementation could involve applying implementation science frameworks to identify and address barriers and facilitators in a systemic way. Second, we only investigated implementation factors from the perspective of intervention participants. Involving multiple stakeholders in future studies could help to understand and integrate the needs, preferences, and values of other stakeholders, resulting in more effective and sustainable implementation of informal practice (Eisman et al., 2021). For example, future studies could involve various stakeholders such as participants engaged with traditional MedBIs, health care providers (e.g., meditation teachers, therapists), MBI developers, and organizations (e.g., mental health clinics, schools). Third, the intervention was delivered within a single meditation app (HMP), which may influence the transferability of the findings to other meditation apps or traditional MedBIs. Fourth, the concept of informal practice may have been unclear to some participants. While participants were encouraged to apply the practices they were learning in the HMP app to daily life (and outside of formal "active" practices guided through the app), this specific terminology may not have been familiar to them. Future studies may overcome this limitation by more explicitly emphasizing the concept of informal practice during the intervention as well as during data collection.

## Conflict of Interest

No donors, either anonymous or identified, have participated in the design, conduct, or reporting of research results in this manuscript. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of any funding parties. CJD is the primary content developer of the Healthy Minds Program and Chief Contemplative Officer at Healthy Minds Innovations, Inc. RJD is the founder and president, and serves on the board of directors for the nonprofit organization, Healthy Minds Innovations, Inc. AQ has a shareholder interest in CHESS Health, a small business that markets a digital health

application for substance use disorder to the addiction treatment field, and provides consulting on digital health implementation through the NIATx Foundation. The remaining authors declare no conflicts of interest with respect to the research, authorship, or publication of this article.

## Ethics Approval

The trial was approved by the Institutional Review Board at the University of Wisconsin – Madison (2019-1578).

## Informed Consent

All participants provided informed consent by completing an online consent form before participating in the larger trial.

## Author Contributions

QX: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Writing – Original Draft, Writing – Review and Editing. RLD: Conceptualization, Data Duration, Formal Analysis, Investigation, Methodology, Writing – Original Draft, Writing – Review and Editing. SUL: Conceptualization, Writing – Review and Editing. CF: Conceptualization, Project Administration, Software, Writing – Review and Editing. CJD: Conceptualization, Resources, Writing – Review and Editing. AQ: Conceptualization, Writing – Review and Editing. INS: Conceptualization, Writing – Review and Editing. RJD: Conceptualization, Funding Acquisition, Writing – Review and Editing. SBG: Conceptualization, Data Duration, Funding Acquisition, Investigation, Methodology, Project Administration, Supervision, Writing – Review and Editing.

## Data Availability

The qualitative interview data are not publicly available.

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## Use of Artificial Intelligence

Artificial intelligence tools were not used in this study.

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**Table 1**

*Demographic Information of Each Participant*

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

**Table 2**

*Four Overarching Categories and Sample Quotes*

| Overarching Categories | Description | Sample Quotes |
|---|---|---|
| Reported Benefits of Informal Practice | Capturing the positive outcomes that participants reported as resulting from their informal practice | "I would try to do one of the breathing things and I think that that did help me turn my brain off." |
| Integration of Informal Practice | Capturing *when* and *how* participants reported utilizing informal practice in their daily lives | "If I'm with friends, like, thinking about some of those [meditation practice] ideas like presence and awareness." |
| Perceived Barriers to Informal Practice | Capturing participants' reported barriers—or their perceptions of barriers others may face—to utilizing informal practice | "Just having an awful day and not being able to... think. Just those days where your mind doesn't really focus (…) not really reflecting." |
| Recommended Facilitators of Informal Practice | Capturing participants' recommendations for encouraging future study participants and other users of HMP to engage in informal practice | "...some tips at the end [of the lesson or guided meditation in the app] of things to keep in mind. If those were easier to reference, if you could just pull up those tips in a different part of the app, that might be helpful." |

**Supplementary Table S1**

*Interview Questions Inquiring about Informal Practice*

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."

1. How have you brought what you learned from the app into your daily life? (Possible probes: differences in time of day, weekday vs. weekend, during different activities)
2. IF PARTICIPANTS 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)
3. IF PARTICIPANTS SAY THEY HAVE PRACTICED: Can you walk me through a specific example of how you have used these practices in daily life?
4. IF PARTICIPANTS 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?)
5. 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)
6. What made it difficult to apply the practices in daily life?