The Role of Home Practice Engagement in a Mindfulness-Based Intervention

by

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Dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Psychology and Neuroscience in the Graduate School of Duke University

2016
ABSTRACT

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Abstract

Over the last three decades, there has been a precipitous rise in curiosity regarding the clinical use of mindfulness meditation for the self-management of a broad range of chronic health conditions. Despite the ever-growing body of evidence supporting the use of mindfulness-based therapies for both medical and psychological concerns, data on the active ingredients of these mind-body interventions are relatively scarce. Regular engagement in formal mindfulness practice is considered by many to be requisite for generating therapeutic change; however, previous investigations of at-home practice in MBIs have produced mixed results. The equivocal nature of these findings has been attributed to significant methodological limitations, including the lack of standardized, systematic practice monitoring tools, and a singular focus on practice time, with little attention paid to the nature and quality of one’s practice. The present study used a prospective, observational design to assess the effects of home-based practice on dispositional mindfulness, self-compassion, and psychological functioning in twenty-eight people enrolled in an MBSR or MBCT program. To address some of the aforementioned limitations, the present study collected detailed weekly accounts of participants’ home-based practice engagement, including information about practice time (i.e., frequency and duration), exercise type, perceived effort and barriers to participation, and practice quality. Hierarchical multiple regression was used to examine the relative contribution of practice time and practice quality on treatment outcomes.
and to explore possible predictors of adherence to at-home practice recommendations.

As anticipated, practice quality and perceived effort improved with time; however, rather unexpectedly, practice quality was not a significant predictor of treatment-related improvements in psychological health. Home practice engagement, however, was predictive of change in dispositional mindfulness, in the expected direction. Results of our secondary analyses demonstrated that employment status was predictive of home practice engagement, with those who were unemployed completing more at-home practice on average. Mindfulness self-efficacy at baseline and previous experience with meditation or other contemplative practices were independently predictive of mean practice quality. The results of this study suggest that home practice helps generate meaningful change in dispositional mindfulness, which is purportedly a key mechanism of action in mindfulness-based interventions.
Dedication

This manuscript is dedicated to the two most remarkable people I know—my parents. Mom and dad, every day I acknowledge your greatness and remind myself of how fortunate I am to be your daughter. Your unyielding love and support will always serve to ground, comfort, and guide me through this unpredictable journey called life.
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1. Introduction

Since the inception of the Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982; 1990) program over three decades ago, there has been burgeoning interest in the concept and practical application of mindfulness for stress-related health concerns. Initially developed in a behavioral medicine setting for patients with intractable, chronic pain (Kabat-Zinn, 1982), this highly experiential, psychosocial intervention has been adapted for use in persons across the life course (Biegel, Brown, Shapiro, & Schubert, 2009; Burke, 2010; Geiger et al., 2015); with diverse clinical profiles (Bohlmeijer, Prenger, Taal, & Cuijpers, 2010; Keng, Smoski, & Robins, 2011); and for delivery across a wide range of clinical and non-clinical institutions (e.g., workplace, schools, professional programs, athletic training programs, correctional facilities, military) (Brewer, 2014; Haase et al., 2015; Klatt, Buckworth, Malarkey, & 2009; Rosenzweig, Reibel, Greeson, Brainard & Hojat, 2003; Samuelson, Carmody, Kabat-Zinn, & Bratt, 2007; Semple, & Lee, 2008).

The seminal work of Kabat-Zinn on MBSR inspired decades of mind-body research and incited the outgrowth of a new “lineage” of mindfulness-based interventions (MBIs) for targeted issues (Cullen, 2011). Among those with the most empirical support are Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2002) for recurrent depression; Mindfulness-Based Relapse Prevention (MBRP; Bowen, Chawla, & Marlatt, 2010) for addictive behaviors; and Mindfulness-Based Eating
Awareness Training (MB-EAT; Kristeller & Wolever, 2010) for binge eating and related disorders. Moreover, mindfulness-related principles and techniques have been heavily incorporated into “third generation” (Hayes, 2004) cognitive-behavioral psychotherapies that emphasize psychological flexibility, acceptance, emotion regulation, and values-consistent living (Chapman, 2006) (i.e., Dialectical Behavior Therapy and Acceptance and Commitment Therapy) (Hayes, Strosahl, & Wilson, 1999; Linehan, 1993).

The secularization of this historically Eastern practice and amassing empirical substantiations of mindfulness as “medicine” have sparked a movement of global proportion, with standardized mindfulness-based programs being offered at hundreds of hospitals, clinics, and academic medical centers worldwide (Cullen, 2011). Clinically and empirically, mindfulness has proven to be an important phenomenon in managing chronic illness and improving the quality of life (Lykins & Baer, 2009).

While there is an ever-expanding body of research demonstrating the physical and psychological health benefits of mindfulness as a clinical intervention (de Vibe, Bjorndal, Tipton, Hammerstrom & Kowalski, 2012; Florback, Arendt, Ornbol, Fink, Walach, 2011; Gotink, Chu, Busschbach, Benson, Fricchione, & Hunick, 2015; Khoury, Lecomte, Fortin, Masse, Therien, Bouchard, et al., 2013; Robins, Keng, Ekblad, Brantley, 2012), the mechanisms and processes underlying these salutary effects have yet to be fully understood. What is more, surprisingly few investigations have evaluated the cruciality of particular components of these programs for effecting therapeutic change.
(e.g., in-class hours, program duration, home-based mindfulness practice)—an area of research that is indispensable, as many of these factors function as barriers to program enrollment and completion.

At-home mindfulness practice, for instance, is a shared treatment component of all formalized MBIs that extends the treatment beyond the once weekly classroom meeting and is considered by nationally recognized mindfulness instructors to be the “transformational backbone” of these programs (Santorelli, 1996). Participation in MBSR or MBCT, for example, entails extensive out-of-session practice; generally, a minimum of 4.5 hours per week, which equates to approximately twice the amount of time spent in the classroom. Despite the strong emphasis placed on developing a disciplined, routine practice, the degree to which mindfulness homework impacts clinical outcomes remains irresolute.

To help address this gap in the literature, the present investigation examined the relationship between home-based mindfulness practice and program outcomes, attending to time spent practicing as well as level of skill acquisition. A secondary aim of this study was to identify participants who may have greater difficulty adhering to the homework recommendations, so as to help instructors better anticipate and address barriers to homework completion. Accordingly, the aims of the present study were two-fold: 1) to examine the relative impact of practice time and practice quality on treatment
outcomes in a mindfulness-based intervention; 2) to explore possible determinants of adherence to at-home practice recommendations.

1.1 Mindfulness: a contemporary psychological construct

“Whether or not one is alive depends on whether one is mindful” (Hanh, 1976, pp. 62-63) [emphasis added]. The construct of mindfulness is one of great complexity and richness; it is “vague and elastic” (Bodhi, 2011) and remarkably difficult to define. The absence of a universal definition of mindfulness has galvanized impassioned discussions both among and between Buddhist scholars and Western scientists. Varying conceptualizations of this construct abound, owing, in part, to the secularization and globalization of this practice (Bergomi, Tschacher, & Kupper, 2013; Chiesa, 2013; Langer & Moldoveanu, 2000), as well as the growing use of mindfulness for clinical and research purposes.

Mindfulness is rooted in Buddhist philosophy, with origins dating back to the fifth century BC (Bodhi, 2011); indeed, mindfulness has been referred to as “the heart of Buddhist meditation” (Thera, 1962). The Buddhist technical term sati was first translated as the English word ‘mindfulness’ in 1881 by Pâli textual scholar T.W. Rhys Davids (Gethin, 2011). In the Buddhist context, Rhys Davids conceptualized mindfulness as:

The memory, recollection, calling-to-mind, being-aware-of, certain specified facts. Of these the most important was the impermanence of all phenomena,
bodily and mental. And it included the repeated application of this awareness to each experience of life, from the ethical view (Rhys Davids, 1910, p. 322, as cited in Gethin, 2011).

With the founding of the MBSR program by Kabat-Zinn in 1979, Buddhist mindfulness practices were being applied clinically in the context of Western medicine and psychology. To make the teachings of the Buddha accessible to mainstream society, Kabat-Zinn “…recontextualized [mindfulness] within the framework of science, medicine, and healthcare so that it would be maximally useful to people who could not hear it or enter into it through the more traditional dharma gates…” (Kabat-Zinn, 2011, p. 288). Mindfulness in this context was non-sectarian and, therefore, taught independently of culture and religion. In this manner, Kabat-Zinn sought to draw attention to the universality of suffering; the human tendencies that reinforce and maintain suffering (Green & Bieling, 2012; Williams & Kabat-Zinn, 2011); and the shared potential to reduce suffering through systematic mental training.

The first ethically-neutral, contemporary definition of mindfulness was provided by Kabat-Zinn, who succinctly characterized it as “paying attention in a particular way: on purpose, in the present moment, and non-judgmentally” (Kabat-Zinn, 1994, p. 4). Bishop and colleagues (2004) later conceived a two-component model of mindfulness (i.e., self-regulation of attention and orientation to experience), expounding on Kabat-Zinn’s earlier definition. In this manner, mindfulness was operationalized as “a process
of regulating attention in order to bring a quality of non-elaborative awareness to current experience and a quality of relating to one’s experience within an orientation of curiosity, experiential openness, and acceptance” (Bishop et al., 2004, p. 243). The importance of enacting a shift from an immersed, first-person state of self-observation to a de-centered perspective of experience was also highlighted—where thoughts and emotions are viewed as transient mental events rather than a construal of reality. The processing of mental content in this way is thought to encourage reflective functioning and non-reactivity (Bishop et al., 2004).

1.2 Mindfulness: a therapeutic discipline

1.2.1 Mindfulness-based interventions

1.2.1.1 MBSR

MBSR (Kabat-Zinn, 1982, 1990) is a patient-centered, group-based approach involving rigorous, systematic training in mindfulness. It is generally delivered over an eight to ten-week period to a medically heterogeneous group of 15-40 people; however, in some settings, MBSR is applied to more targeted populations (e.g., Irving, Dobkin, & Park 2009; Speca, Carlson, Goodey, & Agen, 2000; Young & Baime, 2010) and in a briefer format (e.g., Bergen-Cico, Pessemato, & Cheon, 2013; Mackenzie, Poulin, & Seidman-Carlson, 2006). In-class instruction occurs one day a week for 2 to 2.5 hours and is supplemented with 45 minutes to an hour of daily home assignments, six days a week.
MBSR operates from an educational orientation and includes didactic instruction on several topics (e.g., the tenets of mindfulness; stress physiology and reactivity; the impact of perception and attitude on stress, health and well-being; self-regulation and self-care; intra- and interpersonal communication), all delivered in the context of participant-generated experiences. Participants are also instructed in both formal and informal aspects of mindfulness, educationally and experientially. Guided meditation practices and inquiry into participants’ first-hand experiences with these practices dominate class time. Home-based daily practice assignments are comprised of both formal and informal meditation practices and exercises. Home practice is deemed essential for generalizing treatment gains and giving continuity to one’s practice, and requires a great deal of personal commitment and self-discipline (for an example home practice schedule, see Table 1).

Between weeks six and seven, participants attend an intensive, all-day retreat alongside participants from co-occurring classes and alumni of the program. In silence and with minimal eye contact, participants devote themselves to 6 hours of “non-doing” away from the demands of daily life. Without the usual conduits of distraction and avoidance, participants are impelled to approach intense emotions, pleasant or unpleasant, with open curiosity and compassionate awareness. As such, this day of mindfulness promotes access to deeper dimensions of experience and self-discovery. The program concludes with a review of mindfulness techniques and exercises and a
discussion about maintaining a personal mindfulness practice after the course ends (Kabat-Zinn, 1990).

1.2.1.2 MBCT

MBCT (Segal, Williams, & Teasdale, 2002) is an adaptation of MBSR (Kabat-Zinn, 1982, 1990) that integrates mindfulness practices and principles with elements of cognitive-behavioral therapy (CBT; Beck, Rush, Shaw, & Emery, 1979). MBCT was initially developed as a prevention intervention for recurrent depression, but has since been adapted for persons with a broader range of difficulties (e.g., bipolar disorder, generalized anxiety disorder) (Evans et al., 2008; Williams et al., 2008). MBCT mirrors the MBSR program in format and structure (e.g., 8-week course; group-based format; learning and experiential-based training in formal and informal mindfulness practices; daily home practice requirements), yet demonstrates substantial differences in the content and focus of the didactic instruction. Namely, MBCT includes psychoeducation on how vulnerability to depression develops, with related instruction in identifying and disengaging from “dysphoria-activated depressogenic thinking” and associated patterns of behavior (e.g., experiential avoidance) (Teasdale et al., 2000). Through mindfulness training, participants learn to recognize these habitual, automatic “modes” of thinking and behavior; shift from this mode of response to a more de-centered, open and accepting mode; approach undesirable mind states rather than avoid; and increase awareness of their “relapse signature” – the prodromal symptomatology that can alert
<table>
<thead>
<tr>
<th>Class</th>
<th>Home Practice Assignments</th>
</tr>
</thead>
</table>
| 1     | **Formal Meditation:**  
|       | • Listen to entire “Awareness of Breathing” (AOB) CD at least twice  
|       | • Practice the AOB meditation daily for 15-30 minutes  
|       | • Listen to the entire “Body Scan” portion of the CD at least twice  
|       | • Practice the Body Scan daily  
|       | **Informal Practice:**  
|       | • Eat at least one meal mindfully  
|       | • Experiment with mindful “bites” during snack times or other meals  
|       | • Practice mindful breathing in different situations, for even a few breaths  
|       | • Explore being more mindful of your body sensations in different situations/times of day |
| 2     | **Formal Meditation:**  
|       | • Practice AOB meditation each day for 15-30 minutes  
|       | • Practice the body scan each day  
|       | • Practice walking meditation 10-20 minutes at least three times during the week  
|       | **Informal Practice:**  
|       | • Extend mindfulness further into daily life by doing at least one “chore” mindfully (e.g., washing dishes, brushing teeth, shopping, cleaning)  
|       | • Continue to breathe mindfully during different situations  
|       | • Extend mindfulness to walking in various situations and at different walking speeds |
| 3     | **Formal Meditation:**  
|       | • Practice the AOB meditation daily for 15-30 minutes  
|       | • On alternate days, do either yoga or the body scan  
|       | **Informal Practice:**  
|       | • Use awareness of breath to establish connection and remain present in different situations: pleasant, unpleasant, or neutral  
|       | • “Physicalize” your mindfulness practice by bringing attention to your body and its sensations throughout the day |
| 4     | **Formal Meditation:**  
|       | • Listen to entire “Choiceless Awareness” CD at least twice during the week  
|       | • Practice the choiceless “open” awareness meditation for 15-30 minutes on at least three separate days  
|       | • Do one of the body-related practices (body scan, yoga, or walking meditation) for 30 minutes or more daily  
|       | **Informal Practice:**  
|       | • Tune in mindfully to a specific sensory experience (sights, sounds, tastes, smells, sensations) at least once per day for a few breaths  
|       | • Tune in mindfully to your inner dialogue and moods—just noticing and allowing—at least once per day for a few breaths during the week  
|       | • Practice mindful walking—for even a few steps at any speed—when going from place to place on at least three separate occasions |
Table 1: Continued

<table>
<thead>
<tr>
<th>Class</th>
<th>Home Practice Assignments</th>
</tr>
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<tbody>
<tr>
<td>5</td>
<td><strong>Formal Meditation:</strong></td>
</tr>
<tr>
<td></td>
<td>• Practice the loving kindness meditation using the CD daily</td>
</tr>
<tr>
<td></td>
<td>• Listen to the entire loving kindness CD on at least two days</td>
</tr>
<tr>
<td></td>
<td>• Practice awareness of breathing for 15-30 minutes on at least two days</td>
</tr>
<tr>
<td></td>
<td>• Practice choiceless awareness for 15-30 minutes on at least two days</td>
</tr>
<tr>
<td></td>
<td>• Practice yoga or body scan for at least 15-30 minutes at least two days</td>
</tr>
<tr>
<td></td>
<td><strong>Informal Practice:</strong></td>
</tr>
<tr>
<td></td>
<td>• Tune in to your inner life mindfully for a few breaths in different situations during the day. Notice thoughts, critical judgments, and feelings of intensity and unpleasantness</td>
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<tr>
<td></td>
<td>• Practice doing the loving kindness meditation—just a few phrases—for yourself in times of upset, and for to others in different situations</td>
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<tr>
<td>6</td>
<td><strong>Formal Meditation:</strong></td>
</tr>
<tr>
<td></td>
<td>• For 30 minutes or more each day, practice your choice of yoga, body scan or walking meditation</td>
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<td></td>
<td>• For 20-30 minutes or more each day, practice your choice of awareness of breathing meditation or choiceless awareness meditation</td>
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<tr>
<td></td>
<td>• For 5-10 minutes or more each day, do loving kindness meditation</td>
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<tr>
<td></td>
<td><strong>Informal Practice:</strong></td>
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<tr>
<td></td>
<td>• Explore the practice of mindful breathing in varied situations, both pleasurable and bothersome situations</td>
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<td></td>
<td>• Practice loving-kindness for yourself in upsetting situations</td>
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<tr>
<td></td>
<td>• Become more mindful of what you put into your body, especially through your eyes and ear. Notice the effects of that.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Formal Meditation:</strong></td>
</tr>
<tr>
<td></td>
<td>• You decide which practices and when. Continue to practice at least 1 hour daily. Notice what you do and how you make your decisions</td>
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<tr>
<td></td>
<td>• Try to do a combination of sitting meditation and mindful movements or body-centered practice each day</td>
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<td></td>
<td><strong>Informal Practice:</strong></td>
</tr>
<tr>
<td></td>
<td>• Use the selected practices and extend them into daily life. Establish mindfulness and sustain it as best you can in different situations</td>
</tr>
<tr>
<td></td>
<td>• Continues practicing mindful movement and “tuning in” to your body experiences in various situations</td>
</tr>
<tr>
<td></td>
<td>• Continue working with the loving-kindness—for yourself and others—in different situations</td>
</tr>
<tr>
<td>8</td>
<td><strong>Formal Meditation:</strong></td>
</tr>
<tr>
<td></td>
<td>• The most important part of the work of mindfulness in to keep our practice alive. Anyone can do that.</td>
</tr>
<tr>
<td></td>
<td>• Sit every day. Of you feel you “have no time,” sit for one minute or three minutes.</td>
</tr>
<tr>
<td></td>
<td><strong>Informal Practice:</strong></td>
</tr>
<tr>
<td></td>
<td>• Every moment of your waking life is a moment when greater stillness and awareness is possible. You have what it takes to discover ways to extend mindfulness into your life</td>
</tr>
</tbody>
</table>

*Note:* Homework schedule retrieved from the Duke Integrative Medicine MBSR Course Manual: Foundation Program (2013)
the participant of an impending depressive episode. In the final stages of the intervention, participants develop a concrete relapse prevention “action plan” that outlines self-management strategies to implement when they become aware of these warning signs for relapse. The course concludes with a review of this action plan and a group discussion about applying course materials and techniques to life moving forward (Kuyken & Evans, 2014; Segal, Williams, & Teasdale, 2002).

1.2.2 Salutary effects of systematic mindfulness training

1.2.2.1 Treatment effects

The number of well-designed randomized controlled trials (RCTs) of MBIs has grown assiduously over the past few decades, and the empirical literature evaluating mindfulness training as a clinical intervention suggests benefits that span several dimensions of health and wellness (e.g., emotional, physical, social, spiritual) (Baer, 2003). For instance, mindfulness training has been shown to attenuate the psychological morbidity associated with chronic illness (Abbott et al., 2014; Bohlmeijer, Prenger, Taal, & Cuijpers, 2010); temper the physical symptoms of stress-related medical conditions (e.g., fibromyalgia, psoriasis, irritable bowel syndrome); support immune function, sleep quality, and self-management of disease (e.g., hypertension, diabetes) (Abbot et al., 2014; Biegel, Brown, Shapiro, & Schubert, 2009; Carlson & Garland, 2005; Davidson et al., 2003; Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007; Kabat-Zinn et al, 1998; Weissbecker et al., 2002; Zernicke et al., 2003); improve emotion regulation strategies,
cultivate a state of acceptance, and enhance quality of life in cancer patients (Labelle, Lawlor-Savage, Campbell, Faris, & Carlson, 2015; Speca, Carlson, Goodey, & Angen, 2000; Tamagawa et al., 2015); reduce cravings and substance use and improve the ability to act with awareness in substance use disorders (Bowen, Chawla, & Marlatt, 2010); produce clinically significant reductions in the severity of compulsive eating and mood symptoms in binge eating disorder (Kristeller, Wolever, & Sheets, 2013); and may protect against age-related cognitive decline (Gard, Holzel, & Lazar, 2013; Moynihan et al., 2013). Moreover, greater meditation experience has been associated with higher levels of self-reported mindfulness, self-compassion, and psychological wellbeing; enhanced cognitive flexibility and attentional functioning; increased cortical thickness in areas of the brain involved in sensory processing, the regulation of attention, and interoception; and lower levels of rumination, thought suppression, difficulties with emotion regulation, and psychological symptoms (Lazar et al., 2005; Lykins & Baer, 2009).

RCTs examining the impact of MBSR in clinical and non-clinical populations have shown significant pre-post reductions in self-reported anxiety and depressive symptoms, rumination, perceived stress, experiential avoidance, anger, and medical symptoms. Participation in MBSR has also been associated with improvements in self-reported measures of self-compassion, mindfulness, positive affect, empathy, spirituality, quality of life, and appreciable changes in brain and immune function.
Similarly, RCTs of MBCT in clinical populations have demonstrated reduced relapse rates among remitted depressive patients with 3 or more lifetime episodes; significant improvement in residual depressive symptoms; and increased metacognitive awareness and quality of life. Significant symptom reductions in patients with bipolar depression and anxiety disorders have also been observed following participation in MBCT (Keng et al., 2011).

In a comprehensive meta-analysis of 209 studies, Khoury et al. (2013) examined the therapeutic value of standardized MBIs in a combined total of 12,145 participants with diverse demographic and clinical profiles. The team of researchers reported a moderate effect of MBIs in both pre-post and waitlist-controlled studies (Hedge’s $g = .55$ and .53, respectively) and a small to moderate effect size when compared to other active treatments (e.g., psychoeducation, supportive therapy, imagery, relaxation, art therapy) (Hedge’s $g = .33$). Of note, larger effect sizes were observed in pre-post and waitlist-controlled interventions targeting psychological rather than physical health complaints. This finding was particularly salient for anxiety (Hedge’s $g = .89$ and .96, respectively) and depression (Hedge’s $g = .69$ and .53, respectively). For pre-post and waitlist-controlled studies targeting heterogeneous, non-clinical populations, a medium to large mean effect size was noted (Hedge’s $g = .65$ and Hedge’s $g = .62$, respectively). When compared to traditional CBT or behavioral therapies (Hedge’s $g = -.07$), however, MBIs were no more effective; this was also the case when MBIs were evaluated against
pharmacological treatments (Hedge’s $g = .13$). Concerning clinical outcomes, MBIs were not superior to traditional CBT; however, the researchers remarked that the average attrition rate of the selected MBI trials was lower than that of traditional cognitive and behavioral treatments, suggesting high acceptability of mindfulness training as an intervention for stress-related health concerns.

In a later study, Gotink et al. (2015) systematically reviewed existing meta-analyses and reviews of RCTs using standardized MBSR and MBCT programs. As Khoury et al. (2013) noted, participation in these programs led to greater overall improvement in psychological rather than physical health outcomes. Indeed, the greatest effects were observed on self-reported measures of stress ($d = 0.51$) and the smallest on measures of physical functioning ($d = 0.27$). Significant improvements were also noted in anxiety ($d = 0.49$) and depressive symptoms ($d = 0.37$) and quality of life ($d = 0.39$). Consistently strong effects of MBIs on psychological and psychosocial outcomes, with less robust, indeterminate effects on physical health outcomes appears to be a common finding, with two additional reviews demonstrating the same pattern of results (Abbot et al., 2014; Fjorback, Arendt, Ornbol, Fink, & Walach, 2011).

1.2.2.2 Mindfulness and self-compassion as mediators of effect

Significant treatment-related increases in mindfulness and self-compassion are routinely observed in mindfulness-oriented interventions, and these constructs appear to uniquely contribute to the benefits of MBSR and MBCT despite their conceptual
overlap (Baer, Carmody, & Hunsinger, 2012; Carmody, Reed, Kristeller, & Merriam, 2008; Holzel et al., 2011; Keng, Smoski, Robins, Ekblad, & Brantley, 2012; Robins et al., 2012; Shapiro, Brown, Biegel, 2007; van der Velden et al., 2015). As such, mindfulness and self-compassion have been implicated as potential mechanisms of change in MBIs.

Increases in self-reported mindfulness have been shown to fully or partially mediate the effects of MBIs on psychological health (e.g., positive states of mind, quality of life, sense of coherence) and symptom reduction (e.g., rumination, cognitive reactivity, stress, posttraumatic avoidance, medical symptoms) (Bränstrom et al., 2010; Carmody & Baer, 2008; Dobkin & Zhao, 2011; Nyklicek & Kuijpers, 2008). To corroborate previous research implicating mindfulness as a mechanism of action, Baer and colleagues (2012) examined the trajectories of changes in self-reported mindfulness and perceived stress in an 8-week MBSR program (Baer, Carmody, & Hunsinger, 2012). Statistically significant improvement in mindfulness skills and perceived stress occurred by weeks two and four, respectively, and as anticipated, change in mindfulness during the first three weeks predicted change in perceived stress over the course of the intervention. Secondary analyses of weekly change in home practice revealed that time spent practicing was initially steady, increased during week four, and decreased over the last week. The extent of home-based mindfulness practice over the first three weeks of the intervention was not significantly related to early change in mindfulness skills or perceived stress over the course of the intervention.
Increased mindfulness skills and self-compassion, and reduced rumination and worry were shown to mediate the effects of an 8-week MBCT program on post-treatment symptom reduction and relapse rate; however, the evidence for rumination as a key mechanism of change was relatively weak (van der Velden et al., 2015). In a non-clinical sample of long-term meditators and demographically matched non-meditators, a significant relationship between years of meditation experience and psychological well-being was completely accounted for by a combination of mindfulness and self-compassion scores. Interestingly, when total scores were used, self-compassion (SCS; Neff, 2003) was a stronger predictor of well-being than dispositional mindfulness (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) (Baer, Lykins, & Peters, 2012). Woodruff et al. (2013) also found that single-factor self-compassion (SCS) accounted for a greater percentage of the variance in psychological health than single-factor mindfulness (MAAS; Brown & Ryan, 2007) in a non-clinical sample. Similarly, self-compassion was found to be a more robust predictor of emotional distress and quality of life than mindfulness in a large community-based sample (Van Dam, Sheppard, Forsyth, & Earleywine, 2011).

In a wait-list controlled trial of MBSR, self-compassion and mindfulness significantly mediated the effects of MBSR on fear of emotion; while self-compassion independently mediated the effect of the intervention on worry and mindfulness independently mediated the effect of MBSR on difficulties in emotion regulation. The
researchers interpreted the individual contributions of these constructs as evidence that several unique processes underlie the benefits of MBSR (Keng et al., 2012).

1.3 Program engagement and clinical change

1.3.1 Home-based mindfulness practice

Kabat-Zinn once described meditation practice as “the slow, disciplined work of digging trenches, of working in the vineyards, of bucketing out a pond. [As] the work of moments and the work of a lifetime, all wrapped into one” (Kabat-Zinn, 1994, p.111). MBSR and other mindfulness-based interventions strongly emphasize experiential learning, underscoring the notion that a mere philosophical or academic understanding of what it means to live mindfully is insufficient. Rather, to cultivate the capacity for mindfulness and emotional balance in everyday life—particularly during moments of heightened stress or emotional discomfort—persistence, patience, and regular out-of-class practice are requisite (Kabat-Zinn, 1994). Moreover, mindfulness must become a ‘way of being’, and this is an extremely gradual and interminable process that can only occur through consistent and sustained practice (Grossman & Van Dam, 2011). As such, mindfulness meditation practices and exercises are core components of these interventions, with extensive compulsory home practice assigned daily.

Findings from analogous research on between-session tasks in psychotherapy corroborate the notion of homework as an important mechanism of change, with numerous studies demonstrating a causal link between the inclusion of psychotherapy
homework and treatment outcome (e.g., Kazdin & Mascitelli, 1982; Neimeyer & Feixas, 1990). The extant literature also reports a notable relationship between the degree of homework adherence and therapeutic change in both individual and group therapy settings (e.g., Abramowitz, Franklin, Zoellner, & DiBernardo, 2002; Leung & Heimberg, 1996; Scheel, Hanson & Razzhavaikina, 2004; Startup & Edmonds, 1994). Moreover, better treatment outcomes have been linked to the quality of homework completion and level of skill acquisition. In fact, homework quality appears to be a stronger predictor of pre-post symptom reduction than the absolute amount of homework completed (Kazantzis & Shinkfield, 2007; Schmidt & Woolaway-Bickel, 2000).

In traditional psychotherapy, homework serves to extend the treatment beyond the once weekly, 50-minute session, facilitating the generalization of therapy gains to everyday life experiences and providing an opportunity to ascribe meaning to the therapy process (Suinn, 1990). The integration of homework in therapy also allows the client to take a more active role in their treatment, contributing to a sense of mastery and control over their condition (Detweiler-Bedell & Whisman, 2005; Rector, 2007). MBIs, like the more directive psychotherapeutic approaches, are inherently participatory and require a certain level of commitment. Akin to homework tasks in psychotherapy, home practice assignments in mindfulness-oriented therapies reinforce the broad integration of mindfulness skills in everyday life; provide a medium for developing greater insight into the self-creation of suffering through natural, automatic tendencies; and act to
reveal psychological processes in real time (Fulton, 2014). Moreover, the assignment of home-based practice encourages participants to be intentional about approaching life outside of the classroom with full awareness and equanimity, and serves to guide and reinforce the transition between the “doing mode” of the mind (attempting to resolve negative emotional mind states) and the more favorable “being mode” (mindful awareness of, and openness to, present moment experience) (Langdon, Jones, Hutton, & Holttum, 2011).

In MBSR and related interventions, daily home practice assignments include both formal (i.e., concentrated, uninterrupted daily meditation practice sessions of 10 minutes or longer) and informal practices (i.e., mindfulness during routine activities like eating, walking, brushing teeth, doing dishes) (Kabat-Zinn, 1994). In its standard form, for example, participants enrolled in an 8-week MBSR program are asked to engage in a minimum of 45 minutes of formal mindfulness practice and 5-15 minutes of informal practice, six days a week, for the entire duration of the program (Kabat-Zinn, 1990).

Participants are encouraged to approach their daily homework assignments with an attitude of exploration and to persist even when they do not feel like it or have yet to appreciate any benefit. Considerable class time is allocated to the practice of each of the core formal exercises (i.e., body scan meditation, sitting meditation, gentle Hatha yoga) and discussion of participants’ first-hand experiences with them. Group leaders in MBSR and other standardized MBIs work to make the classroom environment a safe
place for self-disclosure by modeling a curious, open stance toward their personal experiences and those of their students. Obstacles to home mindfulness practice, whether environmental, emotional, or physical, are discussed and normalized during a weekly, in-session period of inquiry, and participants are never disparaged for not completing their homework (Segal, Williams, & Teasdale, 2002).

The importance of maintaining a regular, disciplined practice is consistently emphasized throughout these programs; however, considering the centrality of these daily assignments, empirical investigations designed to characterize the role of home-based mindfulness practice are surprisingly scarce. Moreover, despite what is espoused clinically, previous investigations evaluating the relationship between at-home practice and clinical change have produced mixed results. For instance, in a systematic review of the literature, Vettese and colleagues (2009) revealed considerable inconsistencies in the results of 24 studies that assessed the association between meditation practice and treatment outcome. Namely, only 54% of the studies demonstrated an association between practice and at least one outcome measure in the expected direction (i.e., greater practice yielding greater improvement in outcome); eight studies documented no relationship; and two reported at least one relationship in the opposite direction of what was anticipated. The researchers reasoned that the variable findings were due, in part, to the inadequacy and diversity of practice-monitoring tools as well as differences in the way adherence was operationalized (Vettese, Toneatto, Stea, Nguyen, & Wang,
2009). Others have ascribed these non-significant results to poor homework adherence (Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003) or insufficient statistical power due to small sample sizes (Davidson et al., 2003; Feuille & Pargament, 2013; Finucane & Mercer, 2006; Nyklicek & Kuijpers, 2008; Shapiro, Brown, Biegel, 2007). The general lack of attention paid to the quality of practice has also been implicated (Del Re et al., 2013; Vettese et al., 2009).

There is no apparent consensus regarding the amount of mindfulness practice required for therapeutic change and questions remain regarding the relative impact of practice quality and type (i.e., formal, informal) on outcome. Given the level of personal commitment required for participation in standardized MBIs, it is necessary to clarify the relationship between at-home meditation practice and processes of change.

1.3.1.1 Frequency and duration of home practice

The dose-response relationship between home mindfulness practice and outcome has yet to be determined; however, existing research suggests that regular, consistent engagement in practice (i.e., frequency) has a greater impact on outcomes than total practice amount. For instance, frequency of practice was noted to be a significant predictor of symptom reduction in a randomized, waitlist-controlled trial of MBSR for rheumatoid arthritis (Pradhan et al., 2007); namely, depressive symptoms improved by -0.03 for every one-day increase in practice over the 8-week program ($p = 0.01$). Total practice time was not predictive of change in any post-treatment outcome
measure. Soler et al. (2014) also found that it was more advantageous to practice for shorter periods of time on a daily basis than to only meditate once a week for several hours. In addition to the frequency of practice (days per month), total months of lifetime practice was shown to significantly influence four of the five facets of the Five Facet Mindfulness Questionnaire (i.e., Observing, Awareness, Non-judging, Non-reacting) (FFMQ) and a measure of decentering (Experiences Questionnaire (EQ); Fresco et al., 2007). The length of meditation practice and meditation type (e.g., Mindfulness/Vipassana, Zen, Tibetan, yoga) were not associated with higher mindfulness skills.

Average weekly number of meditation sessions (in-class + at-home) was used to estimate program engagement in an RCT of compassion-based meditation training on stress-reactivity in a healthy adult population (Pace et al., 2009). While there was no main effect of group (meditation vs. control) on neuroendocrine, innate immune, and behavioral responses to a standardized laboratory-stressor (i.e., Trier Social Stress Test [TSST]); significant negative correlations were observed between number of meditation sessions and TSST-induced Interleukin-6 (inflammatory marker) and psychological distress in those randomized to the meditation group. No such relationship was noted between the amount of practice and neuroendocrine responses to psychosocial stress. The researchers suggested that the broad variation in participant willingness and ability to engage in at-home practice ($M = 2.81$, $SD = 1.65$; range 0.55 - 7.01 sessions per week)
may have been responsible for the absence of a main effect of group assignment, and posited that the impact of compassion meditation on stress reactivity may be dose-dependent.

In a subsequent study using a similar experimental paradigm, Rosenkranz et al. (2013) compared MBSR and a well-matched active control intervention on the ability to reduce psychological stress and experimentally-induced inflammation. Across groups, a significant effect of practice time was observed, with greater practice time predicting larger decreases in cortisol release (index of the magnitude of stress response) over the course of the intervention.

Two recent investigations addressing the role of home practice in MBCT for mood disorders also noted significant relationships between frequency of practice (i.e., days per week) and improved outcomes. More specifically, Perich and colleagues (2013) reported that participants who practiced a minimum of 3 days per week demonstrated lower trait anxiety scores at post-treatment than those who practiced an average of 2 or fewer days per week ($z = -2.43, p = .015$). Moreover, those who practiced more tended to report lower post-course self-reported depression scores; however, the differences between the two groups did not reach significance ($z = -1.89, p = .058$). At 12-month follow-up, the trend for the depression scores remained, and a significant difference between the groups on clinician-rated depression scores emerged. Crane and colleagues (2014) reported similar findings in a trial of MBCT for recurrent depression. Namely,
participants who engaged in formal meditation practice on 3 or more days per week were roughly half as likely to relapse over a 12-month follow-up period than those who practiced less frequently ($HR = 0.53$).

In a pilot study investigating the impact of an 8-week MBCT program on the psychological well-being and meditation habits of mental health professionals, Ruths and colleagues (2013) did not appreciate any practice effects immediately post-treatment; however, like the Perich et al. (2013) study, significant associations between time spent meditating and both trait anxiety and psychological well-being emerged at a later time point (i.e., 3-month follow-up). Temporal sequencing studies (e.g., Labelle et al., 2014) support the notion that change in some psychological variables may take longer to appreciate; others suggest that there is some critical threshold of practice time that must be met before change can occur (Shapiro et al., 2007).

In a study examining cross-sectional relationships between self-reported mindfulness, self-compassion, meditation experience, and psychological well-being in experienced meditators (means years of experience, $7.23, SD = 3.88$) and demographically similar non-meditators, years of meditation experience was more strongly correlated with other variables than frequency of practice (times per week, $M = 4.24, SD = 1.82$) or length of practice in minutes ($M = 30.49, SD = 12.27$, range = 20 – 45) (Baer, Lykins & Peters, 2012).
Hölzel and colleagues (2010) investigated pre-post changes in gray matter concentration in 16 healthy, meditation-naive participants who underwent an 8-week MBSR program. The study demonstrated longitudinal changes in brain gray matter concentration in the left hippocampus, and significant structural changes in the posterior cingulate cortex (PCC), temporoparietal junction, and the cerebellum—areas of the brain involved in learning and memory, self-referential processing, perspective taking, and sensory perception and motor control. The research team did not observe a significant relationship between minutes of formal home-based mindfulness practice and changes in gray matter concentration; however, average reported minutes of daily practice was 27 minutes, which appeared sufficient for change.

Rosenzweig and colleagues (2010) observed significant associations between home mindfulness practice and several outcome measures (i.e., overall psychological distress and somatization symptoms, self-rated health, role limitations due to emotional problems, and social functioning) in a study assessing MBSR treatment effects on pain, health-related quality of life, and psychological well-being; however, home-based practice was not associated with a number of other outcomes, including changes in anxiety, depression, bodily pain, and other quality of life subscales (Rosenzweig, et al., 2010). It is plausible that practice “dose” may differ depending on the desired outcome, as has been documented in the exercise literature (Garber et al., 2011).
In an exploratory pilot study of the acceptability and effectiveness of MBCT for primary care patients with active symptoms of depression, generalized anxiety disorder, or mixed anxiety and depressive disorders, the amount of practice time required for the body scan and guided sitting meditation was reduced by 10 and 25 minutes, respectively, to lessen participant burden. While the treatment produced statistically significant reductions in scores on standardized measures of depressive and anxiety symptoms, 5 of the 11 participants continued to endorse moderate to severe levels of depression and/or anxiety at 3-month follow-up. The researchers conjectured that the shortening of some of the longer meditations (i.e., body scan and sitting meditation) may not have given participants adequate time and exposure to fully acquire the mindfulness skills and incorporate them into daily living (Finucane & Mercer, 2006).

Shapiro et al. (2003) found no appreciable difference in sleep efficiency and quality between those who practiced more and those who practiced less in an MBSR intervention aimed at treating sleep disturbance in women with breast cancer; however, they reasoned that low homework adherence rates (i.e., average of 5 minutes of daily practice) might have contributed to the non-significant findings (Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003).

A subsequent study by Shapiro and colleagues (2007) also failed to observe a significant effect of total weekly mindfulness practice time on measures of distress and well-being in a sample of master’s level counseling psychology students. Again, the
researchers noted that time spent in mindfulness practice was quite limited, and the sample size may not have been sufficient to detect small effects of practice time (Shapiro, Brown, Biegel, 2007). Likewise, a lack of statistical power resulting from small sample size was implicated in a study assessing the effects of MBSR on brain and immune function. In this investigation, no significant associations were observed between the frequency and duration of home-based practice and any of the outcome measures—biological or self-report (Davidson et al., 2003).

Other studies have suggested an indirect effect of practice engagement on therapeutic outcomes. In a study assessing the relationship between mindfulness practice and treatment outcome in MBSR, Carmody and Baer (2008) noted significant relationships in the predicted direction between the extent of home-based formal meditation practice and change in mindfulness, well-being, and a number of measures of psychological and medical symptoms; however, increases in mindfulness were shown to completely mediate the relationship between meditation practice and improvement in psychological symptoms and perceived stress, and partially mediate the relationship between practice and psychological well-being.

Hawley et al. (2014) used a statistical mediation approach to examine the possible mediating effects of rumination and distraction on the relationship between mindfulness practice and depressive symptom change in two separate trials of MBSR and MBCT. While the mediating role of distraction was not supported, the researchers
noted that rumination partially mediated the relationship between formal meditation practice and depressive symptom alleviation. Informal meditation practice was not associated with any outcome variable.

1.3.1.2 Formal and informal practice

As previously discussed, mindfulness practice can be formally or informally structured. Formal practice is guided and time-limited; whereas, informal practice is unplanned and does not require a set length of time. Both are considered essential for nurturing present-moment awareness, yet there is more empirical support for the role of formal practice in treatment-related outcomes (Carmody & Baer, 2007; Crane et al., 2014; Hawley et al., 2014).

To gain a greater understanding of the role of informal and formal mindfulness exercises in MBIs, Hindman and colleagues (2015) directly compared stress management programs with and without extended formal meditations and a wait-list control. A Mindfulness Stress Management (MSM) program incorporated principles and techniques from MBSR (Kabat-Zinn, 1990), MBCT (Segal et al., 2002), and ACT (Hayes et al. 1999), and involved psychoeducation about mindfulness and its relationship to stress. The program also included formal and informal mindfulness exercises and time allocated for the discussion of participants’ experiences. Daily homework assignments included both formal (10-30 minutes) and informal practice. The structure and psychoeducational content of the Mindfulness Stress Management--Informal (MSM-I)
program were no different from the MSM program and both programs were co-led by the same instructors; however, in place of the formal mindfulness meditations, students in the MSM-I program completed brief mindfulness and acceptance exercises drawn primarily from ACT and Metacognitive Therapy (Wells et al., 2009). Moreover, their homework was only comprised of informal mindfulness practices. While statistically significant changes in stress, psychological inflexibility, and self-compassion were reported in both programs, greater improvement was observed in MSM compared to MSM-I and the waitlist control. No significant relationships were observed between formal practice time and changes in mindfulness or psychological distress in MSM. Of note, 73% of participants in the MSM-I group compared to 8% in the MSM group reported difficulty remembering to complete the homework.

In a multi-center, randomized controlled trial of MBCT for recurrent depression, Crane and colleagues (2014) assessed the impact of home-based practice on hazard of relapse to depression. Frequency and duration of formal practice and “units” of informal home practice were quantified using data collected from daily home practice diaries. Reported frequency and length of formal practice was 3.36 days ($SD = 1.77$) and 21.31 minutes per day ($SD = 11.39$); mean number of informal practice ‘units’ measured across the entirety of the intervention was 80.44 ($SD = 53.37$). Greater time spent in formal practice predicted a lower hazard of relapse 12 months after the program ended; however, units of informal home meditation practice were not associated with
significant changes in outcome. The team cited the inherent difficulty in capturing the full extent of participants’ engagement in informal practice as a potential explanation for this significant finding. The undefined, impromptu nature of informal practice makes it difficult for participants to enact and researchers to measure.

Carmody and Baer (2007) also reported that— unlike the practice of formal meditation— time spent doing routine activities mindfully (informal practice) was not significantly related to the extent of improvement in mindfulness, psychological functioning, and well-being. Like Crane at al. (2014), Carmody and Baer felt that participants likely had a difficult time accurately assessing informal practice time, and conjectured that this might have contributed to the non-significant finding. The absence of a reliable monitoring tool for informal practice continues to pose a challenge when attempting to appraise the relative contribution of informal practice in MBIs.

1.3.1.3 Exercise type

There has been some preliminary research to suggest differential effects of individual mindfulness exercises on outcome. For instance, an abbreviated, six-week MBSR program for breast cancer survivors demonstrated an association between total hours of mindfulness practice and significant pre-post improvements in physical functioning, pain, emotional well-being, and level of perceived stress. Body scan and sitting meditation were found to be particularly impactful, with total time spent in body scan correlating with significant, positive changes in emotional well-being ($p <.001$), trait
anxiety, depression, perceived stress, and an aggregate measure of mental health \((p < .05)\). In addition to improvements in trait anxiety, perceived stress, and emotional well-being \((p < .05)\), time spent in sitting meditation was also related to significant improvements in physical functioning \((p < .001)\). Walking meditation time was associated with improved physical functioning and reduced fear of breast cancer recurrence \((p < .05)\). Interestingly, total yoga practice time was not significantly related to positive changes in any outcome variable \((Lengacher et al., 2009)\).

In contrast, Carmody and Baer \((2007)\) observed a stronger associated between practice time for mindful yoga practice and beneficial change in mindfulness skills, well-being, and psychological symptoms than practice times for sitting meditation or body scan. They reasoned that it might be easier for some to bring mindful awareness to the body while it is moving than while it is seated or lying down, and that greater practice in mindful movement may make it easier to transfer acquired mindfulness skills into everyday life.

### 1.3.1.4 Quality of home practice

“The sincerity of your efforts matters far more than elapsed time…” \((Kabat-Zinn, 1994, p.123)\). Quality of homework completion in psychotherapy has been linked to better treatment outcomes \((Kazantzis & Shinkfield, 2007)\), and appears to be a stronger predictor of pre-post symptom reduction than the absolute amount of homework completed \((Cammin-Nowak et al., 2013; Schmidt & Woolaway-Bickel, 2000)\); indeed,
many believe that how one practices may be more important than how much one practices in understanding the impact of mindfulness homework on outcome.

Accordingly, Del Re and colleagues (2013) developed and tested a new measure of mindfulness practice quality (Practice Quality-Mindfulness; PQ-M) in a naturalistic sample of MBSR participants. Practice quality was defined as “a balanced perseverence/resolve in receptive and present-moment attention, during the act of formally practicing mindfulness meditation.” An exploratory factor analysis suggested a two-factor structure: 1) Attention (returning to the present moment experience, again and again, no matter how pleasant or unpleasant it may be); 2) Receptivity (willingness to “turn toward” and “lean in” to what is arising in the moment). Predictive convergent validity was supported; namely, the PQ-M and Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003) were significantly related, yet still appeared to be measuring unique constructs, and change in PQ-M scores was associated with significant reductions in psychological distress. The relationship between practice quality and psychological distress remained “marginally significant” when controlling for practice frequency (number of formal practice sessions per week) and dosage (number of minutes of formal practice per week).

In a subsequent study, the developers of the PQ-M assessed the validity of the measure in a new sample and examined the relative contribution of mindfulness practice time (average minutes meditated per day) and change in practice quality in
predicting psychological functioning. The PQ-M was administered weekly to participants enrolled in an 8-week Mindfulness Training for Smokers program (MTS; Davis et al., 2014). The average PQ-M score across all time points was 77.08 (SD = 15.52), with scores increasing, on average, 0.87 each class (SE = 0.23); average reported practice time was 20.89 minutes per day (SD = 9.31). At post-treatment, both practice time and practice quality were predictive of psychological functioning— a composite variable composed of summed scores from the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), the Depression Anxiety and Stress Scales (DASS; Lovibond & Lovibond, 1995), and the World Health Organization Quality of Life-BREF (WHOQOL; WHOQOL Group, 1998)— and remained significant when they were entered into the model simultaneously (practice time: $\beta = 0.29$, $p = .024$; practice quality: $\beta = 0.28$, $p = .027$). At the 5-month post-treatment follow-up session, however, practice time was no longer significantly associated with psychological functioning ($\beta = 0.12$, $p = .399$), but change in practice quality was, and remained so even after controlling for practice time ($\beta = 0.43$, $p = .003$) (Goldberg et al., 2014). The researchers concluded that the PQ-M was a reliable and valid measure, and noted that change in practice quality appeared to be a more robust predictor of improvement in psychological symptoms over time than the amount of practice.
1.3.2 Class contact hours and attendance

1.3.2.1 Treatment duration

The conventional format for MBSR includes 26 hours of in-class time (i.e., eight weekly classes of 2-2.5 hours each and a 6-hour retreat between weeks 6 and 7) (Kabat-Zinn, 1990). As discussed in a subsequent section of this manuscript, the time-intensive nature of this program is consistently endorsed as a barrier to enrollment and program completion. While the standard format has garnered the most empirical support for its efficacy, adaptations of the program that include fewer in-class hours might increase treatment uptake and completion for those with overcommitted schedules or severe illness (Fjorback et al., 2011; Grégoire & Lachance, 2015; Klatt, Buckworth, Malarkey, 2009; Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003; Speca, Carlson, Goodey, & Angen, 2000). To date, however, studies of treatment duration and outcome have produced mixed findings and several have noted that the full eight weeks may be necessary to generate meaningful change in select variables.

Klatt and colleagues (2009) developed a “low-dose” MBSR program for a workplace setting. The duration of the treatment and weekly classroom sessions were reduced to 1 hour per week for six weeks, with less intensive home-practice requirements (20 minutes) and no all-day retreat. The classroom sessions were held at the worksite during the lunch hour, and included practices that could be completed in work attire and without the use of a yoga mat. Didactics were geared toward managing common work-related stressors, and the yoga stretches were designed to accommodate
limited open space. Program adherence among participants was measured at 85%.

Compared to the control group, those in the low-dose MBSR program reported significant improvements in dispositional mindfulness (MAAS; Brown & Ryan, 2003) ($p < .05, d = 0.56$) and perceived stress ($p < .01, d = 0.73$) (PSS; Cohen, Karmarck, & Mermelstein, 1983). Both groups displayed significantly better sleep quality at the end of the six weeks and neither demonstrated changes in average daily salivary cortisol levels over time. The researchers concluded that their low-dose, work-site MBSR program was an effective adaptation for working individuals with limited free time.

Duration of treatment was evaluated as a potential moderator for the magnitude of effect sizes in a meta-analysis of the effects of mindfulness meditation on psychological health. While moderation was not statistically supported, the researchers noted substantial effect sizes and reasoned that the lack of significance was due to the small sample size and lack of statistical power (Eberth & Sedlmeier, 2012).

Carmody and Baer (2009) examined the relationship between number of in-class hours and measures of psychological distress in 30 published trials of MBSR with differing intervention and session duration (4 to 10 sessions; 1 hour to 2.5 hours in duration) and the variable inclusion of an all-day or half-day retreat. Concerning measures of psychological distress, it appeared that shortened versions of MBSR were no less effective than the standard format. There was no association between pre-post treatment effect size and number of in-class hours, and mean pre-post treatment effect
sizes did not differ significantly between studies that included the all-day or half-day session and those that did not.

Bergen-Cico and colleagues (2013) examined the efficacy of a brief MBSR program on the psychological health of college-aged adults. The program was modeled after the first half of the standard 8-week MBSR curriculum and was five weeks in duration, with approximately 10 hours of contact time. About half of the time was spent engaged in the core formal mindfulness meditation practices while the other half was devoted to group discussion and inquiry. Single-factor mindfulness and self-compassion scores increased significantly over the five-week intervention, however, change in trait anxiety did not reach significance ($p = .10$). The researchers suggested that there must be a temporal order of change, with changes in mindfulness and self-compassion preceding changes in psychological distress, and reasoned that a longer duration of treatment may be required to produce clinically significant changes in psychological outcome variables (e.g., anxiety, depression).

Timing and sequence of change in symptoms of stress and mood disturbance, mindfulness, rumination, worry, and experiential avoidance were explored in a longitudinal waitlist-controlled study of Mindfulness-Based Cancer Recovery (MBCR). In this investigation, data was collected at three time points: pre-treatment (time 0), mid-treatment (time 1), and post-treatment (time 2). When compared to controls, participants in MBCR demonstrated significant reductions in patterns of rumination and worry and
improvements in mindfulness variables early on in the program; significant improvements in emotion regulation, mood disturbance and stress-related symptoms were not observed until the second half of the intervention. Early reductions in worry mediated the effect of the intervention on later improvements in symptoms of stress. Change in many of the proposed mechanisms of action in MBIs appear to occur early on in treatment and precede psychological symptom reduction, suggesting that the standard format may be required to improve symptoms of stress and mood disturbance (Labelle, Campbell, Faris, & Calgary, 2014). More research is needed to better understand the temporal sequence of treatment-related change in clinical and non-clinical populations.

1.3.2.2 Attendance

In an 8-week MBCT program modified for healthy individuals, Ruths and colleagues (2012) noted a significant positive relationship between class attendance and levels of dispositional mindfulness and psychological well-being. Similarly, attendance and home practice duration were significant predictors of treatment effect in a slightly abbreviated, 7-week MBSR program for medical and psychology students. Specifically, greater practice times ($\beta = .24, p < .05$) and attendance ($\beta = .25, p < .01$) were associated with lower scores on a standardized measure of mental distress (de Vibe et al., 2013).

Gotink et al. (2015) also observed a dose-response relationship between program engagement and outcome in a meta-analysis of twenty-three RCTs using standardized
MBSR and MBCT programs. Namely, greater reductions in self-reported psychological complaints (e.g., depression, anxiety, stress) were observed in those with greater classroom attendance and practice times.

In a waitlist-controlled study of MBCR, the number of classroom sessions attended— including the all-day retreat— was significantly associated with decreased mood disturbance (Labelle et al., 2014). In another trial of MBCR, greater class attendance was predictive of improved vigor (Profile of Mood States [POMS]; McNair, Lorrr, & Droppleman, 1971), post-traumatic growth (Post-Traumatic Growth Inventory-Revised [PTGI-R]; Tedeschi & Calhoun, 1996), and spirituality (Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being [FACIT-sp]; Peterman, Fitchett, Brady, Hernandez, & Cella, 2002) ($p < .01$), and accounted for a significant portion of the variance in POMS vigor, PTGI, and FACIT-sp (18.7%, 27.9%, and 31.9%, respectively) (Tamagawa et al., 2015).

### 1.4 Adherence in mindfulness-based programs

#### 1.4.1 Classroom sessions

On the whole, class attendance in standardized MBI programs tends to be quite high. In fact, a meta-analysis assessing mindfulness as a clinical intervention reported program completion rates ranging from 60-97%, with a mean completion rate of 85% (Baer, 2003). In a more recent systematic review of RCTs of MBCT and MBSR, 75-97% of
patients randomized to the mindfulness intervention completed the program (attended at least 4 or 5 sessions) (Fjorback et al., 2011).

Completion rates appear to be significantly higher in the MBSR program than in other behavioral health interventions. For instance, depending on the complexity of the treatment regimen, more traditional lifestyle modification programs have exhibited completion rates as low as 30% (Martin, Williams, Haskard, DiMatteo, 2005). One explanation for this difference is the level of participant motivation. Participants enrolled in MBSR and its derivatives tend to be self-referred and self-funded; have an expressed interest in alternative medicine; or have exhausted all other treatment options (Majumdar et al., 2002; Speca, Carlson, Goodey, & Angen, 2000). Indeed, of the participants enrolled in the original MBSR program at the University of Massachusetts Medical Center between 2002-2006, 62% were self-referred (Salmon, Santorelli, Sephton, & Kabat-Zinn, 2009).

1.4.2 Home-based practice component

While classroom attendance in MBIs appears to be consistently satisfactory, adherence to the home-based practice component of MBIs is less reliable. In a systematic review of the mindfulness literature ($N = 98$), Vettese and colleagues (2009) reported significant variations in reported practice times across a subsample of 24 studies. For instance, home-based daily practice times ranged from 5 to 58 minutes ($M = 31.8$ minutes); weekly practice times varied from 55.9 to 84 minutes, and total
intervention times ranged from 5.3 to 30.3 hours (Vettese et al., 2009). The use of inadequate and non-standardized practice monitoring tools may be to blame for these discrepant findings.

**1.5 Determinants of treatment engagement in MBIs**

Poor treatment uptake, suboptimal adherence to treatment recommendations, and program non-completion occur for a variety of reasons, including patient attitudes and expectations about the treatment (e.g., doubt about the value and/or efficacy of the intervention, perceived lack of fit given one’s goals or presenting problem) (Langdon et al., 2011; Ryum, Stiles, Svartberg, & McCullough, 2010); misunderstanding or lack of recall of the prescribed recommendations (Scheel, Hoggan, Willie, McDonald, & Tonin, 1998); characteristics of the treatment itself (e.g., lack of sufficient natural reinforcement early on in treatment because of delayed benefit, complexity of the regimen) (DiMatteo, Giordani, Lepper, & Croghan, 2002; Gaynor et al., 2006); negative therapeutic relationships (e.g., lack of strong therapeutic alliance with instructor; negative interpersonal exchanges between group members or lack of group cohesion) (Goldberg et al., 2013; Ryum et al., 2009); self-efficacy beliefs or perceived behavioral control (Bandura, 1977; Wallston, 2005); problem severity and chronicity (Bryant, Simons, & Thase, 1999; Perich et al., 2013; Worthington, 1986); real or perceived barriers to participation (e.g., financial constraints, lack of time, technological difficulties) (Conoley, Padula, Payton & Daniels, 1994; Eyles et al., 2014; Martinez et al., 2015); and social
support (DiMatteo, et al., 2002). While demographic variables tend to be less reliable predictors of adherence, in general (e.g., Bosley, Fosbury, Cochrane, 1995; Coons et al., 1994; Davis, Jandrisevits, Iles, Weber, & Gallo, 2012; Holzemer, Henry, Portillo, & Miramontes, 2000), age (Langdon et al., 2011), gender (Kabat-Zinn & Waldrop, 1988), and marital status (Tamagawa et al., 2015) have been associated with treatment participation in MBIs.

1.5.1 Predictors of treatment uptake

The time commitment, both in class and at home, is consistently reported as a strong deterrent to enrollment in MBIs. A retrospective qualitative analysis of semi-structured interviews used to explore veterans’ experiences of referral to an 8-week MBSR course revealed strong concerns about time availability and scheduling. Some veterans also reported a strong aversion to the group-based format. Namely, some female veterans cited the presence of men in groups as problematic, while others referenced the potential for group activity to trigger post-traumatic stress disorder (PTSD) symptoms. Perceived lack of fit was also cited as a reason for rejecting involvement in MBSR (Martinez et al., 2015).

The rigorous nature of these standardized programs can be even more problematic for medical and psychiatric inpatients, where the severity of their condition can preclude prolonged participation. Eyles et al. (2014) conducted a mixed-methods feasibility study of mindfulness in women with metastatic breast cancer. Of those
approached to participate, an astounding 80% declined, and 16.25% of those women cited the level of commitment required as the primary deterrent. Other reasons for declining participation were transportation issues, scheduling difficulties with treatments, anticipated side effects of treatments, and family commitments. Thirty-four percent declined for unspecified reasons, and 24% were excluded from the study because they were too ill. Additional qualitative data gathered from participant interviews and focus group members (breast care/research nurses) demonstrated that many of the women who declined participation perceived the course schedule as being too structured and prescriptive, and echoed concerns about the 8-week commitment for terminally ill patients nearing the end of life.

1.5.2 Predictors of adherence to home-based practice in MBIs

Langdon and colleagues (2011) developed a model of mindfulness practice that included what they referred to as the “virtuous practice cycle.” This cycle is comprised of several categories and demonstrates how one maintains their practice; namely, the motivation to practice increases when the practice becomes inherently reinforcing. Other factors that appeared to contribute to greater mindfulness practice included being held accountable to the group; previous therapeutic experience; having positive beliefs about mindfulness; the desire to maintain benefits and avoid the return of past suffering; having a specific time and space reserved for practice; being gentle with oneself when occasional lapses in practice occur; internal health locus of control and good social
support. The factors that tended to hinder ongoing practice included things like impatience, boredom, and fatigue; skepticism regarding the value of mindfulness training; the sense that mindfulness is “self-indulgent;” negative affective states (e.g., stress, anxiety, depression, self-criticism); forced breaks from routine; the perception that society or those closest to you hold negative views of mindfulness; and feeling better, which likely reduced the impetus for ongoing practice (Langdon et al., 2011).

The impact of the group format on participant experience was gleaned from participant interviews in an exploratory, mixed-methods trial of MBCT in primary care (Finucane & Mercer, 2006). On the whole, participants in this trial commented on the positive aspects of being in a group—feeling supported, understood, “not alone.” Participants also noted that group membership helped to normalize their struggles with mental illness, and kept them accountable. For instance, one participant commented on how the group helped her to remain engaged:

I think if you are on your own you would quite easily walk away and give up whereas you’ve got the support there and you know that everybody’s sort of helping you out and you would go back in for the group’s sake and try again (as cited in Finucane & Mercer, 2006)

Task difficulty, generally operationalized based on time to completion and complexity of the task, has been associated with adherence, such that the more difficult the task is perceived to be by the client or participant, the less likely they are to complete
the assignment (Conoley et al., 1994). Moreover, in many cases, therapeutic homework, while having cumulatively significant effects, is initially aversive or does not yield the level of natural reinforcement needed to maintain new behaviors early in treatment. This is particularly salient in mindfulness-based interventions where benefits might be slow to come.

The impact of problem severity on adherence to homework recommendations is unclear--some studies demonstrate a positive association between problem severity and adherence (e.g. Worthington, 1986) while others do not (e.g. Abramowitz et al., 2002; Burns & Spangler, 2000; Bryant et al., 1999). To reconcile these inconsistencies in the literature, researchers have suggested that problem severity may serve to motivate change in persons with mild to moderate illness severity; however, in more severe cases, symptoms may hinder ones’ ability to execute assigned homework tasks (Scheel et al., 2004).

The nature of the presenting problem may also impact treatment engagement; for instance, anxiety symptoms may be more activating and depressive symptoms more demobilizing. This appeared to be the case in an ongoing trial of Mindfulness-Based Cancer Recovery (MBCR) for breast cancer survivors (Tamagawa et al., 2015). Participants who reported higher baseline levels of anxiety spent, on average, more time meditating between sessions. Similarly, those with higher levels of neuroticism demonstrated better class attendance.
Chronicity of the presenting problem has been associated with reduced homework adherence (Bryant et al., 1999). Indeed, the only baseline variable that was significantly related to meditation practice time in a trial of MBCT for bipolar disorder was the number of prior episodes, with more lifetime episodes associated with fewer meditation days (Perich et al., 2013). Similarly, years smoked was the only baseline patient characteristic predictive of practice time in an 8-week mindfulness intervention for smoking cessation ($r = .30, p = .047$) (Goldberg et al., 2014). Moreover, in a trial of MBCT for depression and anxiety disorders, the chronicity and severity of participants’ mental health conditions were identified as some of the most impelling motivators for program participation (Finucane & Mercer, 2006).

Tamagawa et al. (2015) explored the moderating effects of demographic and medical factors, health behavior, personality traits, and coping resources on program attendance and home practice as part of an ongoing trial of mindfulness-based cancer recovery for breast cancer survivors. Women who reported higher levels of self-esteem, social support, and extraversion, and fewer depressive symptoms at baseline spent significantly more time in home yoga practice; marriage and cohabitation were also associated with greater time practicing yoga outside of class. (Tamagawa et al., 2015).

Socioeconomic status may indirectly influence adherence, as disadvantaged communities likely face greater practical barriers to participation. In a study of MBSR and health-related quality of life in a bilingual inner-city patient population, 34% of
participants dropped out for various reasons (i.e., lack of interest, transportation, childcare, and varied family needs). While the completion rate was still quite high at 66%, only 21% attended all eight sessions of the program. The more commonly reported reasons for missed classes included difficulties with transportation and childcare, personal or family illness, inclement weather, family emergencies, and conflicts with medical, social services, or legal appointments (Roth & Robbins, 2004). Despite less than optimal attendance rates, a high percentage of participants indicated that they meditated 4-7 days per week. Home-based practice, by nature, is less susceptible to practical barriers, as participants have the freedom to choose their practice schedules and avoid common hindrances like the absence of childcare or transportation.

Age has also been implicated as a potential predictor of adherence, with advancing age associated with less openness to mindfulness-based therapies, particularly early on in treatment (Langdon et al., 2011).

**1.5.3 Predictors of treatment dropout in MBIs**

Kabat Zinn and Waldrop (1988) evaluated rates and predictors of program completion in a heterogeneous sample of medical patients enrolled in MBSR over a two-year period ($N = 784$). The overall completion rate was 76%, with 9% leaving the program before session 1 and 15% dropping out after the program began. Two major factors were found to distinguish dropouts from treatment completers—gender and the endorsement of emotional distress. Namely, completion rates among male patients with
chronic pain conditions (57%) were significantly lower than completion rates among females with chronic pain (77%) and both males and females with stress-related disorders (80% and 78%, respectively). Moreover, patients with stress-related disorders who reported higher scores on the Obsessive-Compulsive (O-C) subscale of the Symptom Checklist-90 (SCL-90; Derogatis, 1994) were significantly more likely to complete the program, regardless of gender.

Crane and Williams (2010) explored predictors of attrition in persons with a history of suicidal ideation or behavior in a randomized, waitlist-controlled trial of MBCT. Thirty percent of those randomized to the immediate treatment attended fewer than four sessions and were considered treatment non-completers. Of the nine sessions of MBCT, non-completers attended an average of 1.5 (SD = 1.23) classes and completers attending an average of 8.09. This is illustrative of the notion that dropout in MBIs tends to occurs early on in treatment, generally between the orientation session and the first class, or within the first few sessions (Dobkin, Irving, & Amar, 2012; Kuyken et al., 2010). Relative to program completers, non-completers were significantly younger and less likely to be on antidepressants at baseline. They also had significantly higher levels of depressive rumination and brooding, and increased cognitive reactivity to sad mood. Similarly, early dropout was documented in a waitlist-controlled study of MBCR. In this trial, the program dropout rate was estimated at 20%, with 67% of those participants leaving the program after attending only one or two sessions (Labelle et al., 2014).
In an adapted version of MBCT for use in routine psychiatric inpatient and outpatient care settings, the only variable found to be predictive of program completion was the number of sessions attended in the introductory phase (sessions 1-3). No sociodemographic or baseline clinical characteristics (e.g., symptom severity, mindfulness) predicted premature program discontinuation; however, therapists’ assessment of participant motivation and experience with group therapies were valuable indicators of potential dropouts (Herdt, Buhrlen, Bader, & Hanny, 2012). These results suggest that when participants choose to leave a mindfulness-based program, they usually do so in the first three sessions (Hanley, Abell, Osborn, Roehrig & Canto, 2014).

Treatment completers and dropouts did not differ significantly on any demographic variable or baseline measures of symptom severity, quality of life, mood, stress, or spirituality in a randomized controlled trial of MBSR for the treatment of irritable bowel syndrome (IBS). Reported barriers to program completion included scheduling issues, lack of time or interest, transportation difficulties, and breaks in routine (Zernicke et al., 2013).

Targeted populations often have a unique set of obstacles. In an 8-week MBSR program for veterans, the completion rate was 78%. Decisions to leave the program once enrolled were motivated by scheduling conflicts, insufficient time for home practice, medical or surgical problems affecting mobility, difficulty understanding the purpose of MBSR practices, adverse reactions to instructor (e.g., lack of military service, teacher
impact on group structure and focus) or other group members (e.g., mixed-gender and mixed-age cohort, varying eras and levels of military service), physical and psychological challenges with MBSR practice (e.g., chronic pain, physical disabilities due to combat injuries), and environment (e.g., inconsistent or overcrowded classroom setting) (Martinez et al., 2015).

Geiger et al. (2015) reviewed 15 studies evaluating the effects of MBIs on the physical and emotional well-being of older adults. Across all studies, the drop-out rate was 23%, with unexpected or worsening illnesses noted as the most frequent reason for dropping out. A general lack of interest, scheduling conflicts, and mobility/transportation issues were also commonly cited as barriers to program completion.

1.6 Specific aims and hypotheses

The primary objective of the present study was to clarify the role of home-based practice in a structured, 8-week MBSR or MBCT course. To achieve this, study participants were asked to provide weekly detailed documentation of their home practice engagement. Moreover, change over time in several practice qualities was characterized, and their relative contributions to treatment outcomes were evaluated. A secondary aim of this research was to appraise the predictive utility of several variables previously associated with adherence to treatment recommendations in behavioral interventions. Three major hypotheses guided this work:
$H_1$: Adherence to practice time recommendations will be adequate and will not change systematically over the course of the intervention. Practice quality scores will increase linearly over the course of the intervention, with a corresponding decrease in effort ratings and perceived barriers.

$H_2$: Practice quantity and quality measures will both significantly impact treatment-related outcomes of psychological health and well-being; however, how one practices (i.e., practice quality) will be more impactful than how much one practices (i.e., practice frequency and duration).

$H_3$: Adherence to practice time recommendations will be associated with higher baseline levels of mindfulness, self-compassion, mindfulness self-efficacy, and internal locus of control, and fewer self-reported symptoms of psychological distress, emotion dysregulation, and perceived barriers.
2. Materials and methods

2.1 Participants and setting

This study was approved by the Duke University School of Medicine Institutional Review Board (IRB) and was conducted between September 2014 and September 2015. Study participants were recruited from four consecutive cycles of the MBSR program (11 classes; \(n = 93\)) and one cycle of the MBCT program (1 class; \(n = 5\)).

The MBSR program, provided by Duke Integrative Medicine, was offered to a heterogeneous, non-clinical community population; whereas, the MBCT program, held at the Duke Cognitive-Behavioral Research and Treatment Program, was geared toward those with current or remitted anxiety or mood disorders. Persons who presented with severely impaired concentration or memory secondary to depression, significant substance abuse or dissociation, or current psychotic symptoms were not permitted to enroll in the MBCT course.

Seventy-seven participants provided baseline data (see Table 2). This self-selected community sample was largely female (75%), Caucasian (93%), highly educated (mean years of education, 18.11) and affluent, with an average age of 45 years \((SD = 12.80, \text{range}, 19-73 \text{ years})\). Seventy-four percent were married or cohabitating, and seventy-one percent were employed part-time or full-time. At intake, the majority of the sample (69%) endorsed prior experience with mindfulness or another contemplative practice, ranging from less than one month to 180 months (median, 12 months);
moreover, thirty-three percent (n = 25) noted that they were currently practicing. Nearly half of the sample (46%) was self-referred.

The most commonly cited reasons for participating in the MBSR or MBCT programs included: “emotional health benefits” (92%), “physical health benefits” (90%), “increased self-acceptance” (78%), “curiosity/interest in mindfulness” (72%), and “strengthened or better managed relationships” (68%). Other self-reported motivations for program participation were: “to explore or deepen my sense of spirituality,” “stress reduction and management,” “to strengthen awareness and focus,” “to improve memory,” “to establish a consistent practice and stay on track,” and “to improve the ability to sit with strong emotions.” Perceived barriers to home-based practice engagement were also probed at baseline. The most commonly anticipated barriers included: “mind-wandering” (87%), “too many distractions” (84%), “lack of time” (75%), “fatigue” (61%), and “breaks in routine” (53%). Other self-reported barriers included: “concerns about doing it right”, “putting others needs before my own”, and “childcare responsibilities”.

<table>
<thead>
<tr>
<th>Variable</th>
<th>(n = 77)</th>
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<tbody>
<tr>
<td>Age (y), M (SD)</td>
<td>45.34 (12.80)</td>
</tr>
<tr>
<td>Female, (%)</td>
<td>75</td>
</tr>
<tr>
<td>Race/ethnicity, (%)*</td>
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<tr>
<td>Hispanic</td>
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<tr>
<td>Caucasian, non-Hispanic</td>
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<tr>
<td>African American</td>
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<tr>
<td>Asian</td>
<td>1.4</td>
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<tr>
<td>Race/Ethnicity</td>
<td>Percentage</td>
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<tr>
<td>--------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>1.4</td>
</tr>
<tr>
<td>Other</td>
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<table>
<thead>
<tr>
<th>Marital Status</th>
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<tbody>
<tr>
<td>Married or living with partner</td>
<td>73.6</td>
</tr>
<tr>
<td>Separated, divorced, or widowed</td>
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</tr>
<tr>
<td>In an intimate relationship, not living together</td>
<td>4.2</td>
</tr>
<tr>
<td>Single, never married</td>
<td>13.8</td>
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<tr>
<th>Highest Level of Education (%)</th>
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<tbody>
<tr>
<td>Some college</td>
<td>5.6</td>
</tr>
<tr>
<td>College degree</td>
<td>29.2</td>
</tr>
<tr>
<td>Advanced degree</td>
<td>65.2</td>
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</table>

| Years of Education, M (SD)       | 18.11 (2.58) |

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<tr>
<th>Employment Status (%)</th>
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<td>Full-time</td>
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<tr>
<td>Part-time</td>
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<tr>
<td>Unemployed</td>
<td>5.6</td>
</tr>
<tr>
<td>Disabled</td>
<td>6.9</td>
</tr>
<tr>
<td>Retired</td>
<td>16.7</td>
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<tr>
<th>Annual Household Income (%)</th>
<th>Percentage</th>
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<tr>
<td>0-10,000</td>
<td>2.8</td>
</tr>
<tr>
<td>10,001-20,000</td>
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<tr>
<td>20,001-40,000</td>
<td>4.2</td>
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<td>40,001-65,000</td>
<td>14.1</td>
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<td>65,001-100,000</td>
<td>28.2</td>
</tr>
<tr>
<td>&gt; $100,000</td>
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<table>
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<tr>
<th>Referral Source (%)</th>
<th>Percentage</th>
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<tr>
<td>Self-referred</td>
<td>45.5</td>
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<tr>
<td>Friend or family member</td>
<td>24.7</td>
</tr>
<tr>
<td>Primary care physician</td>
<td>3.9</td>
</tr>
<tr>
<td>Mental health provider</td>
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</tr>
<tr>
<td>Other</td>
<td>5.2</td>
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<tr>
<th>Currently Practicing (%)</th>
<th>Percentage</th>
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<tr>
<td></td>
<td>32.5</td>
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<table>
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<tr>
<th>Previous Mindfulness Experience (%)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>68.8</td>
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<table>
<thead>
<tr>
<th>Level of Experience (n = 41), (%)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 months</td>
<td>34.1</td>
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<tr>
<td>4-12 months</td>
<td>19.5</td>
</tr>
<tr>
<td>13-24 months</td>
<td>22</td>
</tr>
<tr>
<td>25-180 months</td>
<td>24.4</td>
</tr>
</tbody>
</table>

Note. M = mean; SD = standard deviation.

*Percentages for race/ethnicity subgroups total greater than 100% because some participants selected multiple categories.
2.2 Study design and procedures

The study used a prospective, observational design to assess the effects of home-based practice on dispositional mindfulness, self-compassion, and psychological functioning in MBSR and MBCT using standardized self-report questionnaires and home practice monitoring.

2.2.1 Recruitment

Study procedures and expectations were presented to potential participants during the pre-program orientation session held one week before their first class; an invitation for study participation was extended at that time. Informed consent was obtained from those who expressed interest along with basic contact information. Study enrollees were assigned a unique subject identification code and provided with written instructions for survey completion. MBSR and MBCT course instructors were not directly involved in the consenting process or assessment procedures, and were not made aware of students’ involvement in the study.

2.2.2 Survey collection

Standardized self-report questionnaires were completed via the Internet before and after participation in an 8-week MBSR or MBCT course. Participants were asked to submit baseline data between the pre-program orientation meeting and their first class. The secure, online survey took about 30 minutes to complete and gathered basic demographic information, treatment-related expectations and motivations, perceived barriers to home-
based practice, and information about prior meditation experience. Standardized measures of mindfulness, self-compassion, and psychological functioning were also included. Once weekly, participants were asked to complete a brief practice monitoring survey, providing detailed information about their home-based practice engagement (i.e., exercise type, frequency and duration of practice, perceived barriers to participation, quality of practice, and perceived effort); these surveys took an average of 3-5 minutes to complete. Within one week of the last class, participants were asked to submit the post-course survey battery. In addition to the measures of mindfulness, self-compassion, and psychological functioning completed at baseline, this assessment battery included several items evaluating perceived program and home practice-related benefits, class attendance, and estimated adherence to the home practice recommendations. This survey took about 30 minutes to complete. All surveys were administered using Qualtrics software (Qualtrics, Provo, UT).

2.2.3 Interventions

2.2.3.1 MBSR

The MBSR program offered through Duke Integrative Medicine was modeled after the curriculum developed by Jon Kabat-Zinn and colleagues at the Center for Mindfulness at the University of Massachusetts Medical Center (Kabat-Zinn, 1982; 1990). The course consisted of 10 group meetings (i.e., pre-program group orientation meeting and brief individual interview, eight weekly 2-2.5 hour classes, and an all-day weekend class), and was taught by highly experienced, well-qualified instructors. The pre-
program orientation meeting was required for program participation and was delivered one week before the start of classes. During this session, prospective enrollees were provided with detailed information about the program—including the level of personal commitment and self-responsibility required; they were encouraged to ask questions about MBSR and discuss their intentions for taking the course and were introduced to some of the mindfulness methods. After orientation, eight weekly class meetings of 2-2.5 hours in duration were delivered over eight weeks. The MBSR curriculum included tailored instruction in the role of stress and reactivity in health and healing, training and engagement in formal mindfulness practices (i.e., awareness of breathing, body scan, walking meditation, mindful yoga, loving kindness, and choiceless awareness), and group dialogue oriented around participants’ first-hand experiences of the program. Enrollees also attended an all-day, silent retreat on a weekend day between weeks six and seven (i.e., Day of Mindfulness). This intensive, 7-hour session was designed to help participants deepen their practice and establish the use of mindfulness skills across a broad range of situations.

Participants were given a workbook, handouts, and CDs containing instructions to guide formal practice. They were asked to engage in a minimum of 45 minutes of daily formal mindfulness practice, six days per week, for the duration of the course. Participants were also encouraged to perform everyday activities (e.g., breathing, brushing their teeth, eating, interpersonal communications) with full awareness of
accompanied physical sensations, cognitions, and feelings and emotions (i.e., informal mindfulness meditation practices). The importance of regular class attendance and completion of daily home practice assignments was emphasized throughout.

2.2.3.1 MBCT

The MBCT group offered through the Duke Cognitive-Behavioral Research and Treatment Program (CBRTP) was modeled after the curriculum developed by Segal, Williams, and Teasdale (2002) and was delivered by two licensed psychologists highly experienced and professionally trained in MBCT. MBCT is a psychosocial prevention intervention for recurrent depression that integrates elements of traditional CBT with components of MBSR. As an adaptation of Mindfulness-Based Stress Reduction, this 8-week, group-based training program overlaps considerably with MBSR in basic format and structure. The program held at the CBRTP consisted of an individual pre-program interview and orientation meeting followed by eight weekly class meetings of 2 hours in duration. As in the MBSR program, participants were instructed in formal and informal meditation practices, engaged in teacher-led discussion and inquiry, and completed daily home practices and exercises facilitated by a guided meditation practice CD (40-50 minutes a day, six days a week). The MBCT curriculum differed from that of MBSR in content and focus. Participants were taught to become more aware of, and to relate differently to, depressogenic thoughts, feelings and bodily sensations (e.g., cultivate acceptance and self-compassion, disengage from habitual, maladaptive cognitive
processes, and observe thoughts and feelings as temporary events of the mind instead of facts) through didactic presentations and instruction in mindfulness meditation practices and exercises derived from cognitive therapy. As in MBSR, the importance of regular class attendance and consistent engagement in home-based practice was routinely highlighted.

2.2.4 Measures

Demographic data form. The demographic data form contained questions about participants’ age, gender, ethnicity, educational background, marital and occupational status, annual income, and prior experience with meditation and mindfulness training.

Depression Anxiety Stress Scales, 21-item version (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 is a widely used, self-report measure designed to discriminate between three negative affective states: depression, anxiety, and tension/stress (see Appendix A). Respondents indicate the frequency and severity of a range of negative emotions (e.g., blue mood, worthlessness, panic, difficulty relaxing) experienced “over the past week” using a 4-point Likert-type scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). The DASS-21 has been shown to be a psychometrically sound tool that can generalize across different populations—clinical and non-clinical (e.g., Anthony, Bieling, Cox, Enns, & Swinson, 1998; Brown, Chorpita, Korotitsch, & Barlow, 1997, younger and older adults (Allen & Annells, 2009; Gloster et al., 2008), and culturally and ethnically diverse groups (e.g., Daza, Novy, Stanley,
Averill, 2002; Norton, 2007). Seven items comprise each of the three subscales, and higher scores indicate greater psychological distress. The DASS-21 has demonstrated acceptable internal consistency reliability and adequate construct validity. The alpha reliability coefficients for the DASS-21 scale scores have been reported as .93 for the Total scale score (Henry & Crawford, 2005) and .91, .80, and .84 for the Depression, Anxiety, and Stress Scales, respectively (Sinclair et al., 2012). Due to the relatively small sample size in the present study, only the Total scale score was used; this measure was administered pre- and post-intervention.

_Difficulties in Emotion Regulation Scale_ (DERS; Gratz & Roemer, 2004). The DERS is a 36-item, self-report measure designed to assess difficulties with various dimensions of emotion regulation (see Appendix B). Items from six subscales (i.e., Nonacceptance, Goals, Impulse, Strategies, Awareness, and Clarity) assess non-acceptance of emotions (e.g., “When I’m upset, I become embarrassed for feeling that way”), inability to enact goal-directed behavior when distraught (e.g., “When I’m upset, I have difficulty getting things done”), difficulties with impulse control (e.g., “When I’m upset, I feel out of control”), restricted access to emotion regulation strategies (e.g., “When I’m upset, I believe that there is nothing I can do to make myself feel better”), poor emotional awareness (e.g., “I pay attention to how I feel”), and limited emotional clarity (e.g., “I am confused about how I feel”), respectively, with higher scores suggesting greater emotion dysregulation. Respondents indicate how often each item applies to them, with
responses ranging from 1 (*almost never*; 0-10% of the time) to 5 (*almost always*; 91-100% of the time). The DERS total scale has demonstrated good internal consistency (α = .93), construct and predictive validity, and test-retest reliability across 4 - 8 weeks (p < .01) (Gratz & Roemer, 2004), and can be reliably used in a racially and demographically diverse sample (Ritschel, Tone, Schoemann, & Lim, 2015). Likewise, each of the six subscales has displayed good internal consistency (α values ranging from .80 to .91) (Bardeen, Fergus, & Orcutt, 2012). Due to the relatively small sample size in the present study, the only the Total scale score was used; this measure was administered pre- and post-intervention.

*Perceived Stress Scale-10 Item Inventory* (PSS-10; Cohen, Kamarck, Mermelstein, 1983; Cohen & Williamson, 1988). The PSS-10 is a 10-item, self-report measure designed to evaluate the extent to which individuals appraise their lives as unpredictable, uncontrollable, and overloaded (see Appendix C). Respondents indicate how often they have felt or thought a certain way using a 5-point Likert-type scale, ranging from 0 (*never*) to 4 (*very often*). Representative items include: “In the last month, how often have you been upset because of something that happened unexpectedly?” and “In the last month, how often have you felt that you were able to control the important things in your life?” The PSS demonstrates good reliability (α = .78) and moderate convergent validity (Cohen & Williamson, 1988). Higher scores on this measure are indicative of
greater perceived psychological stress. In the present study, this measure was administered pre- and post-intervention.

*Patient Health Questionnaire 15-Item Somatic Symptom Severity Scale* (PHQ-15; Kroenke, Spitzer, & Williams, 2002). The PHQ-15 is intended to function as a continuous measure of somatic symptom severity and is derived from the full Patient Health Questionnaire (see Appendix D). Respondents are asked to rate the severity of each of the 15 somatic symptoms or symptoms clusters that account for more than 90% of all physical complaints reported by medical outpatients (e.g., stomachaches, headaches, trouble sleeping) on a 3-point Likert scale, ranging from 0 (*not bothered at all*) to 2 (*bothered a lot*). This measure has good internal consistency (α = .80) and convergent and discriminant validity (Han et al., 2009). Higher scores indicate greater somatic symptom severity. In the present study, this measure was administered pre- and post-intervention.

*Perceived Barrier Scale* (BS; Epstein, Sherwood, Smith, Craighead, Caccia, Lin, et al., 2012). The BS is a 15-item, self-report measure that was adapted for use in the present study (see Appendix E). It was designed to assess perceptions concerning potential barriers to successful participation in a behavioral modification program. For this study, a “barrier” is any external or internal factor inhibiting engagement in at-home practice. Using a 3-point Likert-type scale ranging from 0 (*not at all*) to 3 (*a lot*), individuals are asked to indicate the extent to which they considered each item a barrier to home-based
practice engagement (e.g., “Concerns about doing it ‘right’”, “Physical discomfort”, “Lack of time”, “Too many distractions”). In the present study, this measure was administered pre- and post-intervention and once weekly, for a maximum of 10 assessments.

*Mindfulness Self-Efficacy Scale* (MSE; Chang et al., 2004). The MSE is a 15-item, self-report measure designed to assess participants’ perceived ability to maintain non-judgmental awareness during a variety of situations (e.g., “When you don’t have enough free time for yourself;” “When someone you love hurts you deeply;” “When experiencing pain of eight on a scale of 1 to 10”) (see Appendix F). Respondents are asked to rate their level of confidence using percentages on a scale ranging from 0 (*no confidence*) to 100 (*complete confidence*). The total score is the average percentage of the 15 items, with higher scores reflecting greater mindfulness self-efficacy. The MSE has been shown to be a reliable measure with a Cronbach’s alpha of 0.82 (Chang et al., 2004). In the present study, this measure was administered pre- and post-intervention.

*The Multidimensional Health Locus of Control Scale, Form A* (MHLC; Wallston, Wallston, & DeVellis, 1978). The MHLC-A is an 18-item measure designed to assess participants’ beliefs about internal and external influences on their general health (see Appendix G). This widely used measure contains three 6-item subscales: Internal, Powerful Others, and Chance. Respondents are asked to rate how strongly they agree with belief statements regarding their general health using a 6-point Likert-type scale
ranging from 1 (strongly disagree) to 6 (strongly agree). Example items include: “The main thing which affects my health is what I myself do;” “Health professionals control my health;” “My good health is largely a matter of good fortune.” The scales are moderately reliable, with Cronbach alphas ranging from .60-.75, and test-retest stability coefficients ranging from .60-.70 (Wallston, 2005). In the present study, this measure was administered pre- and post-intervention.

Marlowe-Crowne Social Desirability Scale, form C (MCSDS-C; Reynolds, 1982). The short form of the MCSDS is a 13-item, self-report measure designed to assess and control for response bias; namely, the degree to which an individual’s responses are based on social desirability rather than one’s actual experience (see Appendix H). Controlling for this potential confound is necessary for the present study, as all measurement tools are self-report, including home-based practice records. The MCSDS, form C has been shown to have acceptable internal consistency ($\alpha = 0.62$) and is strongly correlated with the original, 33-item MCSDS ($r = .91$) (Loo & Thorpe, 2000). In the present study, this measure was administered pre- and post-intervention.

Self-Compassion Scale, short form (SCS-SF; Raes, Pommier, Neff, & Van Gucht, 2011). The SCS short form is a 12-item measure designed to assess the construct of self-compassion by asking respondents to indicate how they typically act towards themselves during difficult times using a 5-point Likert-type scale ranging from 0 (almost never) to 5 (almost always) (see Appendix I). Representative items include: “When
something upsets me I try to keep my emotions in balance;” “When I fail at something that’s important to me, I tend to feel alone in my failure;” “When I’m feeling down I tend to obsess and fixate on everything that’s wrong.” Scoring involves calculating average performance across the 12 items, with higher scores indicating greater self-compassion. The internal consistency of the SCS-SF is high ($\alpha = 0.86$) and shows a nearperfect correlation with the long form SCS ($r = 0.98$) (Raes et al., 2011). In the present study, this measure was administered pre- and post-intervention.

*Mindful Attention Awareness Scale* (MAAS; Brown & Ryan, 2003). The MAAS is a 15-item inventory designed to assess the extent to which an individual is attentive to and aware of what is taking place in the present moment (see Appendix J). Respondents are asked to rate how frequently they experience each condition (e.g., “I find it difficult to stay focused on what’s happening in the present;” “I snack without being aware that I am eating”) using a 6-point Likert-type scale, ranging from 1 (*almost always*) to 6 (*almost never*). Scoring involves calculating mean performance across the 15 items, with higher scores indicating greater self-reported mindfulness. The MAAS has been shown to be a reliable (Cronbach’s $\alpha = 0.89$) and valid measure of mindfulness as a psychological construct (MacKillop & Anderson, 2007). In the present study, this measure was administered pre- and post-intervention.

*Practice Quality-Mindfulness Measure* (PQ-M; Del Re, Fluckiger, Goldberg, & Hoyt, 2013). The PQ-M is a six-item measure assessing mindfulness practice quality, and
composed of two dimensions: Attention (e.g., “During practice, I attempted to return to my present-moment experience, whether unpleasant, pleasant, or neutral”) and Receptivity (“During practice, I was actively trying to fix or change certain experiences, in order to get to a ‘better place’”) (see Appendix K). With respect to their most recent practice, respondents are asked to indicate the approximate percentage of time their experience reflected each statement (range = 0-100). The PQ-M is minimally burdensome, taking 1-2 minutes to complete. It has been shown to be a reliable (Cronbach’s α = .81 for total score) and valid measure of practice quality (Goldberg, Del Re, Hoyt, & Davis, 2014), with higher scores indicating a greater level of practice quality. In the present study, the PQ-M was administered once weekly, for a maximum of 8 assessments.

**Perceived effort rating scale.** The effort rating scale is a single-item measure designed to assess perceived effort and striving during mindfulness practice, and ranged from 0 (effortless being) to 10 (effortful doing). The effort rating scale was developed for use in the present study and was administered once weekly, for a maximum of 8 assessments.

**Home-based Mindfulness Practice.** Each week participants submitted a practice monitoring survey, for a maximum of 8 weekly assessments. Participants used an online survey to document time spent engaged in several different types of mindfulness exercises, both formal (i.e., awareness of breathing, body scan, walking meditation,
loving-kindness meditation, mindful yoga, sensory experiences, choiceless awareness) and informal (i.e., mindful eating, mindful chores or daily routines, mindful communication with others, mindful breathing in various situations). Participants also reported the number of days they engaged in formal mindfulness practice.

To quantify home practice engagement (i.e., frequency and duration), an index of meditation practice computed as the average of z-scores of participants’ reported meditation practice, including minutes of home-based formal mindfulness practice and days practiced. This scoring scheme was adopted from Kristeller et al. (2013). In an RCT of MB-EAT for binge eating, the index of meditation practice showed adequate reliability (Cronbach’s alpha = 0.62). The inclusion of practice days in the index was done to give weight to practice consistency—a variable that may be a more robust predictor of outcome than minutes meditated (Perich, Manicavasagar, Mitchell, & Ball, 2013; Schenstrom, Ronnberg, & Bodlund, 2006). In the event that a weekly survey was not submitted, it was assumed that no home practice had occurred that week.

2.3 Statistical analyses

Descriptive statistics were used to summarize baseline sample characteristics and adherence data. Pre- and post- intervention scores on measures of mindfulness, self-compassion, and psychological functioning were compared using paired samples t-tests (two-tailed, $\alpha = .05$). Hierarchical multiple regression was used to examine the relative contribution of practice time and practice quality on treatment outcomes and to evaluate
potential predictors of adherence to at-home practice recommendations. Regression diagnostics were employed to look for influential observations, non-linearly, multicollinearity, and non-independence of errors. Minutes of formal practice and informal practice were log-transformed due to non-normality. Potential covariates were examined by conducting a series of hierarchical multiple regressions of post-intervention scores on corresponding pre-intervention scores and one of thirteen baseline demographic and background variables -- age, gender, race, ethnicity, education, marital and employment statuses, annual income, referral source, previous experience, current practice, recruitment class. All analyses were conducted using SPSS Version 23.0 (Armonk, NY: IBM Corp.).
3. Results

3.1 Preliminary analyses

3.1.1 Survey completion and participant drop-out

Seventy-seven participants completed the pre-course survey battery and 33 (43%) completed the post-course survey assessment. Sixty-two participants (80%) submitted at least one of the eight weekly practice monitoring surveys ($M = 3.38$, $SD = 2.89$; range, 0-8), and 47% ($n = 36$) provided practice data for at least four of the eight weeks. When participants failed to submit a weekly practice survey, the assumption was made that no practice had occurred during that week.

Nine participants voluntarily withdrew from the study. The reasons provided for study dropout included: the time commitment involved with practice monitoring ($n = 4$), premature discontinuation of the MBSR or MBCT course ($n = 2$), death of close friend ($n = 1$), worsening health status and unplanned surgery ($n = 1$), and treatment-related emotional distress ($n = 1$).

Participants were considered study completers if they submitted the pre- and post-course surveys and at least 50% of the weekly practice surveys (4 or more) ($n = 28$). On average, study completers submitted 6.57 surveys ($SD = 1.23$), whereas non-completers submitted 2.65 surveys ($SD = 1.97$). Potential differences between completers ($n = 28$) and non-completers ($n = 49$) were examined using logistic regression, with ‘completion status’
treated as a binary variable (yes/no); the two groups did not differ significantly on any demographic characteristic or baseline measure.

### 3.1.2 Class attendance and home practice engagement

Class attendance data was collected as part of the post-course survey; therefore, we have no record of program attendance for those who did not complete this post-intervention assessment battery. The subsample of people who submitted the post-course survey ($n = 33$) attended an average of 7.44 classes (range, 5-8), and a vast majority (73%) attended the all-day, silent retreat. One-hundred percent of those who completed the post-course survey reported that they planned to maintain a regular practice long-term. When asked about the perceived contribution of home-based practice to total program benefit, 67% felt that it contributed a lot, 18% felt that it contributed some, 9% felt it contributed a little, and 6% felt it contributed nothing. On average, participants estimated that they adhered to the daily home practice recommendations about 56% of the time. Of the barriers endorsed in the present study, “too many distractions” was consistently rated as one of the biggest obstacles when completing the daily home practice assignments, with 84% of the sample reporting that environmental distractions impacted their practice to some degree. “Lack of time,” “mind-wandering,” “breaks in routine,” “fatigue,” and “concerns about doing it ‘right’” were also noted to have impacted their home practice participation (82%, 79%, 76%, 55%, and 46%, respectively). Additional self-reported barriers included: unanticipated
health issues (e.g., hospital admissions, illness, injury, and surgery), life events (e.g., death in family, dissertation defense), technical difficulties with the mindfulness CD, lack of good space, family responsibilities, houseguests, and emotional distress (e.g., unwanted thoughts, impatience).

### 3.1.3 Correlations among baseline dependent variables

Correlations among dependent measures at baseline are shown in Table 3; results did not suggest redundancy among these measures. Most correlations were in the moderate range, with the highest occurring between the Self-Compassion Scale and the Difficulties in Emotion Regulation Scale ($r = -0.74$).

#### Table 3: Intercorrelations of outcome measures at baseline

<table>
<thead>
<tr>
<th>Variable</th>
<th>DASS</th>
<th>DERS</th>
<th>PSS</th>
<th>SCS</th>
<th>MAAS</th>
<th>PHQ-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>DASS</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DERS</td>
<td>0.70**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSS</td>
<td>0.65**</td>
<td>0.64**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCS</td>
<td>-0.62**</td>
<td>-0.74**</td>
<td>-0.69**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAAS</td>
<td>-0.50**</td>
<td>-0.54**</td>
<td>-0.47**</td>
<td>0.50**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>PHQ-15</td>
<td>0.37**</td>
<td>0.19*</td>
<td>0.48**</td>
<td>-0.24*</td>
<td>0.10</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note.* DASS-21 = Depression Anxiety and Stress Scales, 21-item; PSS-10 = Perceived Stress Scale, 10-item; DERS = Difficulties in Emotion Regulation Scale; MAAS = Mindful Attention and Awareness Scale; SCS-12 = Self-Compassion Scale, short form; BS = Barrier Scale; Mindfulness Self-Efficacy Scale; PHQ-15 = Patient Health Questionnaire, somatic symptom severity scale. *$p < .05$; **$p < .01$ (2-tailed).
3.2 Primary analyses

3.2.1 Pre-post change in outcome variables

Paired-samples t-tests were performed to evaluate treatment-related changes in measures of psychological health. As predicated, participants reported significantly higher levels of dispositional mindfulness ($t(28) = -11.74, p = .000, d = -2.22$) and self-compassion ($t(28) = -3.09, p = .005, d = -0.58$) at post-treatment than at pre-treatment. Participants also demonstrated significant pre-post reductions in emotion dysregulation ($t(28) = 3.82, p = .001, d = 0.71$), negative affect ($t(29) = 3.80, p = .001, d = 0.70$), and perceived stress ($t(29) = 2.23, p = .034, d = 0.41$). Pre-post effect sizes were calculated using the formula suggested by Rosenthal (1994) for matched pairs data ($d = t/\sqrt{\text{degrees of freedom}}$). Effect sizes were large for dispositional mindfulness, medium to large for self-compassion, difficulties in emotion regulation, and negative affect, and small to medium for perceived stress and somatic symptom severity (Cohen, 1988) (see Table 4).
Table 4: Treatment-related changes in mindfulness, self-compassion, and psychological functioning

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Pre-treatment M (SD)</th>
<th>Post-treatment M (SD)</th>
<th>t (df)</th>
<th>p-value</th>
<th>Cohen’s d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological Distress (DASS-21)</td>
<td>12.38 (9.64)</td>
<td>7.77 (7.24)</td>
<td>3.80 (29)</td>
<td>.001**</td>
<td>0.70</td>
</tr>
<tr>
<td>Perceived Stress (PSS-10)</td>
<td>18.00 (6.81)</td>
<td>15.03 (5.54)</td>
<td>2.59 (29)</td>
<td>.015*</td>
<td>0.48</td>
</tr>
<tr>
<td>Difficulties in Emotion Regulation (DERS)</td>
<td>78.77 (24.66)</td>
<td>68.67 (20.04)</td>
<td>3.82 (29)</td>
<td>.001*</td>
<td>0.71</td>
</tr>
<tr>
<td>Dispositional Mindfulness (MAAS)</td>
<td>2.86 (0.80)</td>
<td>4.27 (0.68)</td>
<td>-11.74 (28)</td>
<td>.000***</td>
<td>-2.22</td>
</tr>
<tr>
<td>Self-compassion (SCS-12)</td>
<td>2.94 (0.83)</td>
<td>3.28 (0.70)</td>
<td>-3.09 (28)</td>
<td>.005**</td>
<td>-0.58</td>
</tr>
<tr>
<td>Somatic Symptom Severity (PHQ-15)</td>
<td>6.83 (4.80)</td>
<td>5.73 (4.39)</td>
<td>1.73 (29)</td>
<td>.094†</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Note. DASS-21 = Depression Anxiety and Stress Scales, 21-item; PSS-10 = Perceived Stress Scale, 10-item; DERS = Difficulties in Emotion Regulation Scale; MAAS = Mindful Attention and Awareness Scale; SCS-12 = Self-Compassion Scale, short form; BS = Barrier Scale; Mindfulness Self-Efficacy Scale; PHQ-15 = Patient Health Questionnaire, somatic symptom severity scale

*p < .10; *p < .05; **p < .01; ***p < .001 (2-tailed).
3.2.2 Home practice characteristics over time

Table 5 and Figure 1 display participants’ home practice engagement over the course of the 8-week intervention. As predicted, effort ratings and perceived barriers decreased with time, while practice quality increased. Practice engagement, quantified using the practice quantity index, was not expected to change systematically over the course of the intervention; however, when consecutive weeks were compared using paired samples t-tests, a significant drop-off in practice engagement was observed between weeks one and two ($t(59) = 3.06, p = .003$), and again between weeks five and six ($t(61) = 3.16, p = .002$). Moreover, home practice engagement at weeks six, seven, and

![Figure 1: Standardized practice data over time](image-url)
eight was significantly different from practice engagement at week one ($t(59) = 4.77, p < .001; t(59) = 3.49, p = .001; t(59) = 4.24, p < .001$, respectively), with fewer reported minutes of home practice in the latter half of the intervention.

Perceived effort decreased systematically over time, with noticeable change occurring around week four. When comparing consecutive weeks, the difference in average effort rating between weeks four and five was marginally significant ($t(28) = 1.90, p = .067$). Weeks four, five, six, seven, and eight were all significantly different from week one ($t(31) = 3.26, p = .003; t(32) = 5.07, p < .001; t(16) = 3.35, p = .004; t(18) = 4.11, p = .001; t(16) = 3.36, p = .004$, respectively), with a non-significant trend between weeks one and three ($t(31) = 1.93, p = .062$). Similarly, perceived barriers decreased linearly over time. When comparing consecutive weeks, barriers dropped significantly between weeks two and three ($t(28) = 2.46, p = .020$). Perceived Barrier Scale scores at weeks four, six, seven, and eight were significantly different from those reported at week one ($t(34) = 2.06, p = .047; t(22) = 2.24, p = .037; t(21) = 2.59, p = .017; t(17) = 2.64, p = .017$, respectively), with a non-significant trend between weeks one and three ($t(32) = 1.90, p = .066$). Practice quality at week four was significantly higher than week three ($t(25) = -2.61, p = .015$), and weeks five and six were significantly different from week one ($t(30) = -2.77, p = .010; t(18) = -2.18, p = .043$, respectively).
Table 5: Home practice engagement by week

<table>
<thead>
<tr>
<th>Variable</th>
<th>Week 1 (n = 62)</th>
<th>Week 2 (n = 62)</th>
<th>Week 3 (n = 62)</th>
<th>Week 4 (n = 62)</th>
<th>Week 5 (n = 62)</th>
<th>Week 6 (n = 62)</th>
<th>Week 7 (n = 62)</th>
<th>Week 8 (n = 62)</th>
<th>Total (n = 496)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice time (min/d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal</td>
<td>31.15 (21.84)</td>
<td>22.58 (33.69)</td>
<td>24.33 (24.01)</td>
<td>26.28 (26.09)</td>
<td>28.47 (44.67)</td>
<td>16.95 (30.64)</td>
<td>24.38 (40.75)</td>
<td>17.05 (39.29)</td>
<td>24.08 (18.22)</td>
</tr>
<tr>
<td>Informal</td>
<td>12.75 (20.20)</td>
<td>15.15 (34.16)</td>
<td>13.33 (26.45)</td>
<td>14.42 (31.38)</td>
<td>16.68 (42.47)</td>
<td>11.37 (35.21)</td>
<td>15.28 (47.92)</td>
<td>11.03 (42.52)</td>
<td>13.70 (27.35)</td>
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<tr>
<td>Days practiced</td>
<td>3.88 (2.20)</td>
<td>2.75 (2.73)</td>
<td>2.48 (2.53)</td>
<td>2.92 (2.71)</td>
<td>2.67 (2.75)</td>
<td>1.67 (2.47)</td>
<td>1.92 (2.66)</td>
<td>1.68 (2.64)</td>
<td>2.47 (1.87)</td>
</tr>
<tr>
<td>Quality Rating (0-100)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>67.68 (17.24)</td>
<td>70.18 (18.51)</td>
<td>67.70 (17.53)</td>
<td>70.56 (15.87)</td>
<td>76.27 (14.58)</td>
<td>76.56 (16.61)</td>
<td>75.13 (18.10)</td>
<td>76.35 (18.86)</td>
<td>69.81 (13.68)</td>
</tr>
<tr>
<td>Perceived Barriers (0-33)</td>
<td>6.82 (3.26)</td>
<td>7.47 (3.79)</td>
<td>5.86 (3.05)</td>
<td>6.00 (2.84)</td>
<td>5.72 (3.12)</td>
<td>5.00 (2.39)</td>
<td>4.64 (2.36)</td>
<td>4.81 (3.28)</td>
<td>6.24 (2.64)</td>
</tr>
<tr>
<td>Effort Rating (0-10)</td>
<td>6.35 (2.20)</td>
<td>5.94 (2.19)</td>
<td>5.40 (2.29)</td>
<td>5.47 (1.73)</td>
<td>4.68 (1.74)</td>
<td>4.25 (2.38)</td>
<td>3.91 (1.98)</td>
<td>4.14 (2.31)</td>
<td>5.64 (1.94)</td>
</tr>
</tbody>
</table>

Note. M = mean; SD = standard deviation.
3.2.3 Effect of practice time and quality on treatment outcome

Practice engagement (practice quantity index) and practice quality were entered into regression models as predictors of post-treatment outcome (see Table 7). All models controlled for the baseline scores on each dependent variable and practice values were evaluated for co-linearity. Greater practice engagement significantly predicted pre-post change in dispositional mindfulness ($\beta = 0.55$, $p < .001$), even after controlling for mean practice quality. There was a marginally significant association between greater practice engagement and changes in both self-compassion ($\beta = 0.28$, $p = .053$) and somatic symptom severity ($\beta = 0.26$, $p = .065$), over and above quality of practice. Unexpectedly, practice engagement did not predict statistically meaningful pre-post improvement in psychological functioning, and despite what has been shown in the literature, mean practice quality did not prove to be a more robust predictor of treatment-related change than time spent practicing. In fact, practice quality did not predict pre-post change in any of the outcome measures.
### Table 6: Change in mindfulness predicted by practice time and practice quality

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>B [95% CI]</th>
<th>SE B</th>
<th>β</th>
<th>t (df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baseline MAAS</td>
<td>0.46 [0.24, 0.68]</td>
<td>0.11</td>
<td>0.63</td>
<td>4.24 (27)</td>
<td>.000***</td>
</tr>
<tr>
<td>2</td>
<td>Baseline MAAS</td>
<td>0.26 [0.06, 0.46]</td>
<td>0.10</td>
<td>0.36</td>
<td>2.70 (26)</td>
<td>.012*</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>0.38 [0.20, 0.57]</td>
<td>0.09</td>
<td>0.56</td>
<td>4.21 (26)</td>
<td>.000***</td>
</tr>
<tr>
<td>3</td>
<td>Baseline MAAS</td>
<td>0.26 [0.05, 0.47]</td>
<td>0.10</td>
<td>0.36</td>
<td>2.61 (25)</td>
<td>.015*</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>0.38 [0.18, 0.57]</td>
<td>0.09</td>
<td>0.55</td>
<td>4.01 (25)</td>
<td>.000***</td>
</tr>
<tr>
<td></td>
<td>Practice Quality</td>
<td>0.00 [-0.01, 0.02]</td>
<td>0.06</td>
<td>0.05</td>
<td>0.41 (25)</td>
<td>.686</td>
</tr>
</tbody>
</table>

Note. MAAS = Mindful Attention and Awareness Scale; CI = confidence interval; SE = standard error
† p < .10; *p < .05; **p < .01; ***p < .001 (2-tailed)

### Table 7: Change in self-compassion predicted by practice time and practice quality

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>B [95% CI]</th>
<th>SE B</th>
<th>β</th>
<th>t (df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baseline SCS</td>
<td>0.61 [0.37, 0.85]</td>
<td>0.12</td>
<td>0.70</td>
<td>5.16 (27)</td>
<td>.000***</td>
</tr>
<tr>
<td>2</td>
<td>Baseline SCS</td>
<td>0.55 [0.31, 0.79]</td>
<td>0.12</td>
<td>0.64</td>
<td>4.74 (26)</td>
<td>.000***</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>0.18 [-0.02, 0.37]</td>
<td>0.09</td>
<td>0.26</td>
<td>1.89 (26)</td>
<td>.070†</td>
</tr>
<tr>
<td>3</td>
<td>Baseline SCS</td>
<td>0.58 [0.34, 0.83]</td>
<td>0.12</td>
<td>0.68</td>
<td>4.85 (25)</td>
<td>.000***</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>0.19 [-0.00, 0.39]</td>
<td>0.10</td>
<td>0.28</td>
<td>2.04 (25)</td>
<td>.053†</td>
</tr>
<tr>
<td></td>
<td>Practice Quality</td>
<td>0.00 [-0.02, 0.01]</td>
<td>0.00</td>
<td>-0.14</td>
<td>-1.02 (25)</td>
<td>.317</td>
</tr>
</tbody>
</table>

Note. SCS = Self-Compassion Scale, short form; CI = confidence interval; SE = standard error
† p < .10; *p < .05; **p < .01; ***p < .001 (2-tailed)
Table 8: Change in psychological distress predicted by practice time and practice quality

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>B [95% CI]</th>
<th>SE B</th>
<th>β</th>
<th>t (df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baseline DASS</td>
<td>0.50 [0.28, 0.72]</td>
<td>0.11</td>
<td>0.66</td>
<td>4.64 (28)</td>
<td>.000***</td>
</tr>
<tr>
<td>2</td>
<td>Baseline DASS</td>
<td>0.47 [0.25, 0.69]</td>
<td>0.11</td>
<td>0.63</td>
<td>4.42 (27)</td>
<td>.000***</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>-1.36 [-3.48, 0.77]</td>
<td>1.04</td>
<td>-0.19</td>
<td>-1.31 (27)</td>
<td>.201</td>
</tr>
<tr>
<td>3</td>
<td>Baseline DASS</td>
<td>0.44 [0.21, 0.67]</td>
<td>0.11</td>
<td>0.58</td>
<td>3.88 (26)</td>
<td>.001**</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>-1.16 [-3.33, 1.01]</td>
<td>1.06</td>
<td>-0.16</td>
<td>-1.10 (26)</td>
<td>.283</td>
</tr>
<tr>
<td></td>
<td>Practice Quality</td>
<td>-0.08 [-0.23, 0.09]</td>
<td>0.08</td>
<td>-0.15</td>
<td>-0.96 (26)</td>
<td>.348</td>
</tr>
</tbody>
</table>

Note. DASS-21 = Depression Anxiety and Stress Scales, 21-item; CI = confidence interval; SE = standard error
† p < .10; *p < .05; **p < .01; ***p < .001 (2-tailed)

Table 9: Change in perceived stress predicted by practice time and practice quality

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>B [95% CI]</th>
<th>SE B</th>
<th>β</th>
<th>t (df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baseline PSS</td>
<td>0.48 [0.20, 0.76]</td>
<td>0.14</td>
<td>0.56</td>
<td>3.51 (27)</td>
<td>.002**</td>
</tr>
<tr>
<td>2</td>
<td>Baseline PSS</td>
<td>0.43 [0.14, 0.73]</td>
<td>0.14</td>
<td>0.50</td>
<td>3.03 (26)</td>
<td>.005**</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>-1.05 [-2.93, 0.84]</td>
<td>0.92</td>
<td>-0.19</td>
<td>-1.14 (26)</td>
<td>.264</td>
</tr>
<tr>
<td>3</td>
<td>Baseline PSS</td>
<td>0.38 [0.06, 0.69]</td>
<td>0.15</td>
<td>0.44</td>
<td>2.46 (25)</td>
<td>.021*</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>-0.92 [-2.82, 0.99]</td>
<td>0.92</td>
<td>-0.17</td>
<td>-0.99 (25)</td>
<td>.331</td>
</tr>
<tr>
<td></td>
<td>Practice Quality</td>
<td>-0.07 [-0.21, 0.07]</td>
<td>0.07</td>
<td>-0.18</td>
<td>-1.05 (25)</td>
<td>.304</td>
</tr>
</tbody>
</table>

Note. PSS-10 = Perceived Stress Scale, 10-item; CI = confidence interval; SE = standard error
† p < .10; *p < .05; **p < .01; ***p < .001 (2-tailed)
Table 10: Change in difficulties in emotion regulation predicted by practice time and practice quality

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>B [95% CI]</th>
<th>SE B</th>
<th>β</th>
<th>t (df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baseline DERS</td>
<td>0.51 [0.26, 0.77]</td>
<td>0.13</td>
<td>0.61</td>
<td>4.09 (28)</td>
<td>.000***</td>
</tr>
<tr>
<td>2</td>
<td>Baseline DERS</td>
<td>0.48 [0.21, 0.74]</td>
<td>0.13</td>
<td>0.57</td>
<td>3.72 (27)</td>
<td>.001**</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>-3.54 [-9.76, 2.67]</td>
<td>3.03</td>
<td>-0.18</td>
<td>-1.17 (27)</td>
<td>.252</td>
</tr>
<tr>
<td>3</td>
<td>Baseline DERS</td>
<td>0.48 [0.19, 0.76]</td>
<td>0.14</td>
<td>0.57</td>
<td>3.48 (26)</td>
<td>.002**</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>-3.52 [-9.96, 2.92]</td>
<td>3.13</td>
<td>-0.18</td>
<td>-1.12 (26)</td>
<td>.272</td>
</tr>
<tr>
<td></td>
<td>Practice Quality</td>
<td>-0.01 [-0.48, 0.46]</td>
<td>0.23</td>
<td>0.00</td>
<td>-0.04 (26)</td>
<td>.966</td>
</tr>
</tbody>
</table>

Note. DERS = Difficulties in Emotion Regulation Scale; CI = confidence interval; SE = standard error
† p < .10; *p < .05; **p < .01; ***p < .001 (2-tailed)

Table 8: Change in somatic symptom severity predicted by practice time and practice quality

<table>
<thead>
<tr>
<th>Model</th>
<th>Predictor</th>
<th>B [95% CI]</th>
<th>SE B</th>
<th>β</th>
<th>t (df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baseline PHQ</td>
<td>0.71 [0.44, 0.99]</td>
<td>0.13</td>
<td>0.72</td>
<td>5.42 (28)</td>
<td>.000***</td>
</tr>
<tr>
<td>2</td>
<td>Baseline PHQ</td>
<td>0.69 [0.43, 0.96]</td>
<td>0.13</td>
<td>0.69</td>
<td>5.42 (27)</td>
<td>.000***</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>1.02 [-0.17, 2.20]</td>
<td>0.58</td>
<td>0.23</td>
<td>1.76 (27)</td>
<td>.091†</td>
</tr>
<tr>
<td>3</td>
<td>Baseline PHQ</td>
<td>0.68 [0.42, 0.95]</td>
<td>0.13</td>
<td>0.68</td>
<td>5.28 (26)</td>
<td>.000***</td>
</tr>
<tr>
<td></td>
<td>Practice Quantity Index</td>
<td>1.15 [-0.08, 2.39]</td>
<td>0.60</td>
<td>0.26</td>
<td>1.93 (26)</td>
<td>.065†</td>
</tr>
<tr>
<td></td>
<td>Practice Quality</td>
<td>-0.04 [-0.13, 0.05]</td>
<td>0.04</td>
<td>-0.12</td>
<td>-0.93 (26)</td>
<td>.361</td>
</tr>
</tbody>
</table>

Note. PHQ = Patient Health Questionnaire, somatic symptom severity scale; CI = confidence interval; SE = standard error
† p < .10; *p < .05; **p < .01; ***p < .001 (2-tailed)
### 3.3 Secondary analyses

#### 3.3.1 Predictors of practice engagement

Employment status was the only demographic, behavioral, or clinical variable that significantly predicted practice engagement ($B = -0.62, SE = 0.26, p = .018$), with those who were unemployed, retired, or disabled participants engaging in more home-based practice than those who were employed full or part-time.

#### 3.3.2 Predictors of mean practice quality

For practice quality, higher levels of baseline mindfulness self-efficacy ($B = 0.12, SE = 0.06, p = .045$) and previous mindfulness meditation experience ($B = 10.62, SE = 4.92, p = .032$) were predictive of greater mean PQ-M scores. Increasing age ($B = 0.34, SE = 0.19, p = .082$) and higher baseline self-compassion scores ($B = 5.63, SE = 3.00, p = .062$) were marginally significant predictors of greater mean practice quality.

### 3.4 Exploratory analyses

#### 3.4.1 Relative impact of formal and informal practice on treatment outcome

Minutes of formal and informal practice were highly correlated ($r = .49, p = .005$). Pearson correlations between post-treatment scores on psychological health variables and weekly informal and formal meditation practice minutes are displayed in Table 8. Greater weekly formal meditation practice time was significantly associated with improved mindfulness ($r = .76, p = .000$) and perceived stress ($r = -.38, p = .036$), and marginally associated with improvements in self-compassion ($r = .36, p = .050$) and
somatic symptom severity \((r = .31, p = .085)\). Greater weekly informal practice time was significantly associated with higher levels of mindfulness \((r = .51, p = .004)\) and self-compassion \((r = .43, p = .019)\). Weekly formal practice time significantly predicted change in dispositional mindfulness, controlling for time spent engaged in informal mindfulness practice \((\beta = .57, p = .006)\). Informal practice time was not predictive of meaningful change in any of the outcome measures.

### 3.4.2 Impact of exercise type on treatment outcome

Table 8 also displays Pearson correlations between post-treatment scores on dependent measures and total time spent in sitting meditation, body scan, walking meditation, and yoga. Greater time spent in sitting meditation, walking meditation, and yoga was significantly associated with higher levels of dispositional mindfulness at the end of treatment \((r = .645, p < .001; r = .424, p = .016; r = .494, p = .004\), respectively). More intervention time spent engaged in sitting meditation was also associated with higher levels of post-treatment self-compassion \((r = .348, p = .051)\), however, this association did not reach significance at the \(p < .05\) level. An unexpected trend between greater sitting meditation time and higher self-reported somatic symptom severity was also noted \((r = .322, p = .068)\). Lower levels of post-treatment perceived stress \((r = -.359, p = .040)\) and difficulties in emotion regulation \((r = -.490, p = .004)\) were significantly correlated with time spent in body scan, and non-significant trends between minutes in body scan and self-compassion \((r = .318, p = .076)\) and negative affect \((r = -.314, p = .075)\) were also
observed. In addition to higher levels of post-treatment mindfulness, yoga practice time was also significantly associated with lower levels of perceived stress ($r = -0.379, p = 0.029$) at end of treatment. Moreover, the relationship between yoga practice time and self-compassion scores was marginally significant ($r = 0.346, p = 0.052$).

Table 9: Correlations between post-treatment outcome scores and exercise type

<table>
<thead>
<tr>
<th></th>
<th>Sitting</th>
<th>Body Scan</th>
<th>Walking</th>
<th>Yoga</th>
<th>Formal</th>
<th>Informal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>DASS</td>
<td>-.23</td>
<td>-.31†</td>
<td>-.03</td>
<td>-.13</td>
<td>-.28</td>
<td>-.10</td>
<td>-.42*</td>
</tr>
<tr>
<td>PSS</td>
<td>-.21</td>
<td>-.36*</td>
<td>-.06</td>
<td>-.38*</td>
<td>-.38*</td>
<td>-.23</td>
<td>-.52**</td>
</tr>
<tr>
<td>DERS</td>
<td>-.08</td>
<td>-.49**</td>
<td>-.11</td>
<td>-.22</td>
<td>-.23</td>
<td>-.11</td>
<td>-.26</td>
</tr>
<tr>
<td>PHQ</td>
<td>.32†</td>
<td>-.06</td>
<td>.15</td>
<td>-.11</td>
<td>.31†</td>
<td>.03</td>
<td>-.48**</td>
</tr>
<tr>
<td>SCS</td>
<td>.35†</td>
<td>-.32†</td>
<td>.25</td>
<td>.35</td>
<td>.36†</td>
<td>.43*</td>
<td>.50**</td>
</tr>
<tr>
<td>MAAS</td>
<td>.65**</td>
<td>.57**</td>
<td>.42*</td>
<td>.49**</td>
<td>.76**</td>
<td>.51**</td>
<td>.44*</td>
</tr>
</tbody>
</table>

† $p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$ (2-tailed)
4. Discussion

The primary purpose of this investigation was to help clarify the role of home-based practice in standardized MBSR and MBCT programs. In accordance with what has been previously reported, significant pre-post improvements were observed in measures of dispositional mindfulness, self-compassion, and psychological functioning. As anticipated, perceived effort and barriers to participation decreased over the course of the intervention, with practice quality increasing. Of note, substantial reductions in perceived barriers and effort ratings appeared to precede meaningful change in self-reported practice quality. Moreover, the composite index for home practice engagement, derived from session frequency and duration data, predicted treatment-related increases in dispositional mindfulness and marginally significant improvements in self-compassion and somatic symptom severity. While practice engagement did not significantly predict pre-post improvements in psychological functioning, it did generate notable change in a key mediator of treatment effect (i.e., dispositional mindfulness).

Consistent with existing research, formal mindfulness practice time (but not informal) was predictive of improved psychological health (Hawley et al., 2015; Shapiro et al., 2009), and mindfulness exercise type appeared to differentially impact treatment outcome (Carmody & Baer, 2007; Lengacher et al., 2009). Namely, in the present study, total intervention time spent in the body scan exercise was strongly associated with
significant reductions in difficulties in emotion regulation and perceived stress, and total yoga practice time was related to meaningful reductions in perceived stress. Walking meditation, yoga, and sitting meditation times were all positively associated with post-treatment dispositional mindfulness scores, however, sitting meditation appeared to exert the greatest influence ($p < .001$). Lengacher et al. (2009) similarly observed more robust associations between the body scan and sitting meditation exercises and outcomes as compared to yoga and walking meditation. In the present study, the majority of participants’ practice time was spent in body scan and sitting meditation which may have impacted the observed results.

Despite what has been reported in the literature (Del Re et al., 2013; Goldberg et al., 2014), average practice quality was not a robust predictor of treatment outcome in the present study. In fact, mean practice quality was not predictive of change in any of the primary outcome measures. This could be explained by the wide range of previous experience with meditation or other contemplative practices endorsed by this sample (range, 0-180 months). For instance, it has been argued that highly refined training and sustained personal practice are required to achieve a proper appreciation of what it means to be mindful (Chiesa, 2013). Indeed, this is a frequent criticism of existing self-report measures of mindfulness. In the present study, a weak semantic understanding of the items on the PQ-M and minimal practical experience to fully appreciate and recognize the degree of mind-wandering and inattention may have led novice
meditators to overestimated practice quality at the outset of the intervention (Grossman, 2008, 2011). In fact, it is possible that participants’ mean practice quality scores declined over time as awareness increased. Likewise, those with greater meditation experience and a more advanced understanding of the intricacies and nuances of mindfulness may have documented lower levels of mindfulness practice quality throughout. Moreover, scores on the PQ-M may have been unduly impacted by respondents’ self-concept, with level of self-efficacy or self-esteem dictating one’s perception of practice quality. Alternatively, PQ-M scores may have been a reflection of one’s “aspirations [rather than] achievement” (Grossman & Van Dam, 2011). Given the intensive, eight-week commitment to classroom and home-based mindfulness meditation practice, actual acquisition of mindfulness skills may have been unconsciously overrated.

As expected, adherence to the classroom component of the MBSR and MBCT programs was high, with study completers attending an average of 7.44 class sessions and a vast majority (73%) participating in the all-day silent retreat. Moreover, participants spent an average of 38 minutes a day in home-based mindfulness practice and study completers practiced an average of 4.52 (SD = 2.15) days per week. High levels of adherence in MBSR and its derivatives are consistently reported throughout the literature (e.g., Fjorback et al., 2011; Labelle et al., 2014; Speca et al., 2000). Reliable participation in MBIs is a phenomenon that can be accounted for using analogous research on adherence in more traditional forms of therapy. For instance, the required
orientation session that precedes enrollment in MBSR and MBCT helps to enhance participants’ understanding of the treatment rationale and process, and affords participants the opportunity to address any concerns they may have. During orientation, instructors are very transparent about what participation entails, including the level of commitment required to achieve a beneficial effect. In this manner, individuals are provided with the requisite knowledge needed to make an informed decision about whether program participation is indicated given their treatment goals and limitations.

For participants to adhere to treatment recommendations, they must display an accurate understanding of the assignments, both in action and rationale (Tompkins, 2004). Formal meditation practices are modeled by the instructors and practiced by participants during classroom meetings. In concert with experiential training, weekly didactics and group discussions ensure that all participants have a good grasp of the weekly practice assignments. Adequate recall of homework recommendations is also essential for homework completion. A CD of guided meditations and a workbook containing a schedule and information about weekly homework assignments are distributed to participants at the outset of the intervention, which may help to improve recall and facilitate adherence (e.g., Secker, Kazantzis, Pachana, 2004). Moreover, participant feedback regarding home practice recommendations is directly elicited during weekly in-class periods of inquiry; at this time, stated concerns are validated, normalized, and problem-solved by instructors and fellow group members. Extensive
homework review and sharing of participants’ first-hand experiences also occurs on a weekly basis. Indeed, homework review has been implicated as one of the most important predictors of adherence to between-session tasks in psychotherapy, particularly in CBT (e.g., Bryant et al., 1999; Worthington, 1986).

In the present study, unemployment status, which included those who were retired and disabled, predicted greater compliance with home-based practice recommendations. As discussed previously, lack of time appears to be a universal barrier to reliable participation in MBSR or MBCT. Those with more unrestricted time throughout the day and greater flexibility in their schedule are better positioned to complete the extensive daily practice requirements.

Unsurprisingly, higher levels of baseline mindfulness self-efficacy and previous mindfulness meditation experience predicted greater mean PQ-M scores. Across a range of psychotherapies and lifestyle modification programs participants’ beliefs and expectations (e.g., self-efficacy beliefs, health locus of control) have been implicated as important predictors of treatment adherence (Murray, Craigs, Hill, Honey, & House, 2012). The construct of self-efficacy is often discussed in the context of a particular domain of behavior and represents a perceived capability and level of confidence (Azliyana, Justine, & Kuan, 2013; Bandura, 1977). Behavior-specific self-efficacy has been shown to be a reliable predictor of adherence to health behavior recommendations (e.g., exercise) (Sherwood & Jeffrey, 2000) and appears to increase with repeated exposure to
that particular behavior (McAuley, 1992). In the present study, participants who perceived a lower likelihood of success may have experienced greater difficulty mobilizing despite having a strong desire to engage in the daily homework assignments. Potential gains in mindfulness-specific self-efficacy across the intervention likely increased participants’ sense of personal agency and perceived practice quality.

Perceptions of controllability of one’s health can also significantly impact treatment adherence. Measures of health locus of control (LOC) have been shown to predict engagement in recommended health behaviors. Individuals with high internal LOC believe that they are responsible and in control of their health and tend to exhibit better dietary habits and lower rates of smoking and excessive alcohol use as a result. On the contrary, persons with high external LOC reason that external sources (e.g., doctors, chance, fate) exert greater control over their health (Wallston, Wallston, & Devellis, 1978). In general, these individuals are less likely to participate in preventative health behaviors and are more liable to engage in unhealthy behaviors (Norman, 1995; Wurtele, Britcher, & Saslawsky, 1985). Surprisingly, health locus of control was not a significant predictor of home-based practice adherence in the present study.

While instructors’ mindfulness experience, therapeutic alliance, and group-effects were not assessed in the present study, it is possible that these variables impacted both practice engagement and outcome. The central role of therapeutic alliance in individual psychotherapy has been well-established. Correspondingly, the affective
bond between participants and instructors in group-based therapies appears to be an important factor in treatment outcome (Fluckiger, Del Re, Wampold, Symonds, & Horvath, 2012; Horvath, Del Re, Fluckiger, & Symonds, 2011; Ryum, Hagen, Nordahl, Vogel, & Stiles, 2009). For instance, mid-treatment therapeutic alliance, as measured by the Working Alliance Inventory-Group Version (WAI-G; Horvath & Greenberg, 1989), was shown to predict post-treatment improvement in negative affect, emotion regulation, mindfulness, and treatment compliance (i.e., minutes meditated) in an RCT of a mindfulness-based smoking cessation treatment based extensively on the MBSR program (Goldberg et al., 2013). Similarly, Bowen and Kurz (2012) assessed the ability of between-session formal practice and therapeutic alliance to predict levels of mindfulness in an 8-week MBRP program. Estimated practice time was collected at weeks four and eight and total practice time was assessed as a predictor of change. Between-session practice was found to predict dispositional mindfulness scores at the end of treatment but not at 2 and 4-month follow-up. Therapeutic alliance (WAI-S; Tracey & Kokotovic, 1989) was significantly related to post-course scores on a standardized mindfulness questionnaire (FFMQ; Baer et al., 2006), with stronger client-rated therapeutic alliance predicting higher levels of mindfulness at end of treatment and 2-month follow-up, over and above the effects of home practice. These results suggest that therapeutic alliance may exercise its influence, in part, by affecting participants’ engagement in key aspects of the treatment (i.e., home-based practice).
Several constructs characterizing the therapeutic relationships among group members (e.g., alliance, cohesion, climate, empathy) have been shown to significantly impact the effects of group-based treatments (Ryum et al., 2009). For instance, Hoberman and colleagues (1988) demonstrated the importance of group cohesion in a clinical sample of adults with depressive disorders enrolled in a group treatment for depression. Early positive perceptions of group cohesiveness (a sense of belonging) predicting significant improvements in scores on a measure of depressive symptoms severity (Hoberman, Lewinsohn, & Tilson, 1988). While homework adherence was not considered in the Ryum et al. study, it is possible that group cohesiveness and the provision of support affected participants’ engagement in the treatment. Indeed, this was the case in a grounded theory study of MBCT designed to assess facilitators and barriers to continued practice and a mixed-methods study of MBCT in primary care (Finucane & Mercer, 2006; Langdon et al., 2011). Strong therapeutic relationships with group members and instructors likely contributed to the high rates of adherence in the present study.

Therapists’ experience with mindfulness has also been associated with improved outcomes in MBIs. Indeed, in a comprehensive meta-analysis evaluating the efficacy of mindfulness-based therapies, therapists’ mindfulness experience positively moderated the effect size of the treatments on clinical outcomes ($\beta = .13, SE = .04, p < .001$) (Khoury et al, 2013). While all of the MBSR and MBCT instructors at Duke Integrative Medicine
and the CBRTP were highly experienced and professionally trained, there is still value in
determining the impact of their mindfulness experience and training on participants’
level of practice engagement and treatment outcome.

4.1 Limitations

The present study has several important limitations that should be considered.
The most significant limitation was the high rate of attrition and missing data. While
program adherence was high, adherence to the study protocol was quite low. For
example, only 36% of participants completed pre- and post-treatment measures and at
least four of the eight weekly practice assessments. The completer-sample was limited \( n = 28 \) and likely reduced the statistical power needed to detect small home-practice
effects. What is more, when participants failed to submit a weekly practice monitoring
survey, a value of zero was recorded for that week, which likely generated conservative
estimates of practice engagement.

The sample was demographically homogenous, with the vast majority of
participants being well-educated, female, and Caucasian. Moreover, this was a
convenience sample drawn from individuals who had already attended the orientation
meeting of an MBSR or MBCT program. As such, participants were likely intrinsically
motivated. Indeed, almost half of the sample was self-referred. In conjunction with high
sample attrition, the self-selected nature of the sample limits the generalizability of
study findings.
Attempts were made to address the methodological limitations in previous adherence-outcome investigations by regularly collecting detailed practice data over the course of the intervention, assessing practice quality, and utilizing online survey software to discourage socially desirable responding. While social desirability scores were not associated with reported practice times and practice quality, we cannot guarantee that participants consistently reported actual practice times. Moreover, if participants were making retrospective estimates of their practice at the end of the week instead of documenting practice in real time, they may have unknowingly recorded inaccurate practice times. Retrospective, self-reported estimates of homework adherence tend to be systematically biased by client status (Burns & Spangler, 2000; Mausbach, Moore, Roesch, Cardenas, & Patterson, 2010); namely, homework adherence is often overestimated by participants when treatment response is high and underestimated when treatment response is low (Bryant, Simons, & Thase, 1999; Gaynor, Lawrence, & Nelson-Gray, 2006). Retrospective ratings are also susceptible to forgetting, particularly in older adults. These issues pose an even greater challenge when estimating informal practice times, as these exercises are unstructured and not time-delineated. Inaccurate appraisals of mindfulness in everyday life may have limited our ability to discern the effects of informal practice on outcome.

Submission of the weekly practice monitoring surveys in the present study may have encouraged home practice adherence and indirectly affected outcomes as a result
(Korotitsch & Nelson-Gray, 1999). For instance, in a study assessing predictors of dietary change in postmenopausal women, consistent self-monitoring behavior—quantified by the number of records submitted—was one of the strongest predictors of adoption and maintenance of a low-fat dietary pattern (Tinker et al., 2007).

Lastly, to reduce participant burden, measures of psychological health were not included in the weekly surveys. Without this data it is impossible to know the temporal sequence of change in study variables (Labelle et al., 2014; Strunk, Brotman, DeRubeis, 2010). Determining the timing of change and relationships among changes in practice characteristics, mindfulness, self-compassion, and psychological outcomes would help to further clarify the impact of home practice on outcome.

### 4.2 Future Directions

Future studies should examine the impact of instructor (e.g., instructor skill and experience, instructor qualities, therapeutic alliance) and treatment-related factors (e.g., group format) on level of participation in mindfulness-based treatments. Moreover, when evaluating the role of participant characteristics in program adherence, psychological process variables should be targeted as opposed to demographic or clinical characteristics, as demographic qualities are often unchangeable and, therefore, cannot be addressed by program developers and instructors (Crane and Williams, 2010).

Consistent recommendations for adherence reporting and practice-monitoring are needed, particularly when documenting engagement in informal mindfulness practices.
practices. It will also be important to develop more reliable measures of practice quality. As noted before, the PQ-M is likely susceptible to biased reporting related to degree of mindfulness experience. Results from a real-time functional magnetic resonance imaging study of meditation in highly experienced meditators (Garrison et al., 2013) suggested that the quality of one’s practice suffers when effort is high; as such, a measure of perceived effort may prove to be a valuable tool for clinicians and course instructors when trying to gauge skill acquisition in mindfulness-oriented therapies.

Systematic mindfulness training has emerged as a trans-diagnostic treatment approach for a broad range of emotional and physical health concerns; however, mindfulness is not a panacea and has been shown to produce iatrogenic effects in some (e.g., anxiety, depression, psychosis) (Hanley et al., 2016). It will be important to better catalogue adverse effects and improve our understanding of contraindications in specific populations.

Lastly, the field would greatly benefit from additional time-series analyses of change in mechanisms of action and outcomes during MBIs; component-controlled, dismantling studies evaluating the contribution of several important treatment components to the efficacy of the intervention as a whole; and an updated systematic review of home practice in MBIs, akin to the one completed by Vettese et al. in 2009.
4.3 Conclusion

The adage “some is good; more is better” does not fully capture the complexities of mindfulness practice in mindfulness-based therapies. Determining the optimal “dose” of home practice in MBIs is likely a futile undertaking, as the amount and type of practice needed to bring about change almost certainly differs based on the desired health outcomes and innumerable idiosyncratic differences among participants. While home-based practice appears to underlie the beneficial effects of MBIs to some degree, more research is needed to further our understanding of how this multi-faceted construct exerts its influence, and whether this process differs among individuals with varying clinical and sociodemographic profiles. Such work may lead to important changes in the assignment and review of mindfulness homework, thereby expanding the reach and maximizing the effectiveness of mindfulness-based treatments.
Appendix A

Depression, Anxiety, and Stress Scales, 21 item version (DASS-21)

Please read each statement and circle a number 0, 1, 2 or 3, which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1. I found it hard to wind down
2. I was aware of dryness of my mouth
3. I couldn't seem to experience any positive feeling at all
4. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)
5. I found it difficult to work up the initiative to do things
6. I tended to over-react to situations
7. I experienced trembling (e.g., in the hands)
8. I felt that I was using a lot of nervous energy
9. I was worried about situations in which I might panic and make a fool of myself
10. I felt that I had nothing to look forward to
11. I found myself getting agitated
12. I found it difficult to relax
13. I felt down-hearted and blue
14. I was intolerant of anything that kept me from getting on with what I was doing

15. I felt I was close to panic

16. I was unable to become enthusiastic about anything

17. I felt I wasn’t worth much as a person

18. I felt that I was rather touchy

19. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)

20. I felt scared without any good reason

21. I felt that life was meaningless
Appendix B

Difficulties in Emotion Regulation Scale (DERS)

Please indicate how often the following statements apply to you by writing the appropriate number from the scale below on the line beside each item.

1 Almost never (0-10%)
2 Sometimes (11-35%)
3 About half the time (36-65%)
4 Most of the time (66 – 90%)
5 Almost always (91-100%)

1. I am clear about my feelings.
2. I pay attention to how I feel.
3. I experience my emotions as overwhelming and out of control.
4. I have no idea how I am feeling.
5. I have difficulty making sense out of my feelings.
6. I am attentive to my feelings.
7. I know exactly how I am feeling.
8. I care about what I am feeling.
9. I am confused about how I feel.
10. When I’m upset, I acknowledge my emotions.
11. When I’m upset, I become angry with myself for feeling that way.
12. When I’m upset, I become embarrassed for feeling that way.
13. When I’m upset, I have difficulty getting work done.
14. When I'm upset, I become out of control.

15. When I'm upset, I believe that I will remain that way for a long time.

16. When I'm upset, I believe that I'll end up feeling very depressed.

17. When I'm upset, I believe that my feelings are valid and important.

18. When I'm upset, I have difficulty focusing on other things.

19. When I'm upset, I feel out of control.

20. When I'm upset, I can still get things done.

21. When I'm upset, I feel ashamed with myself for feeling that way.

22. When I'm upset, I know that I can find a way to eventually feel better.

23. When I'm upset, I feel like I am weak.

24. When I'm upset, I feel like I can remain in control of my behaviors.

25. When I'm upset, I feel guilty for feeling that way.

26. When I'm upset, I have difficulty concentrating.

27. When I'm upset, I have difficulty controlling my behaviors.

28. When I'm upset, I believe there is nothing I can do to make myself feel better.

29. When I'm upset, I become irritated with myself for feeling that way.

30. When I'm upset, I start to feel very bad about myself.

31. When I'm upset, I believe that wallowing in it is all I can do.

32. When I'm upset, I lose control over my behaviors.

33. When I'm upset, I have difficulty thinking about anything else.
34. When I'm upset, I take time to figure out what I'm really feeling.

35. When I'm upset, it takes me a long time to feel better.

36. When I'm upset, my emotions feel overwhelming.
Appendix C

Perceived Stress Scale-10 Item (PSS-10)

Instructions: The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way.

0 Never
1 Almost never
2 Sometimes
3 Fairly often
4 Very often

1. In the last month, how often have you been upset because of something that happened unexpectedly?
2. In the last month, how often have you felt that you were unable to control the important things in your life?
3. In the last month, how often have you felt nervous and "stressed"?
4. In the last month, how often have you felt confident about your ability to handle your personal problems?
5. In the last month, how often have you felt that things were going your way?
6. In the last month, how often have you found that you could not cope with all the things that you had to do?
7. In the last month, how often have you been able to control irritations in your life?
8. In the last month, how often have you felt that you were on top of things?
9. In the last month, how often have you been angered because of things that were outside of your control?

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?
Appendix D

*The Patient Health Questionnaire, somatic symptom severity (PHQ-15)*

During the past 4 weeks, how much have you been bothered by any of the following problems?

0 Not bothered at all  
1 Bothered a little  
2 Bothered a lot

a. Stomach pain

b. Back pain

c. Pain in your arms, legs, joints (e.g., knees, hips, etc.)

d. Menstrual cramps or other problems with your periods (WOMEN ONLY)

e. Headaches

f. Chest pain

g. Dizziness

h. Fainting spells

i. Feeling your heart pound or race

j. Shortness of breath

k. Pain or problems during sexual intercourse

l. Constipation, loose bowels, or diarrhea

m. Nausea, gas, or indigestion
n. Feeling tired or having low energy

o. Trouble sleeping
Appendix E

Perceived Barriers Scale (BS)

How much do you expect each of the following to impact your ability to engage in the home-based practice component of the MBSR or MBCT program?

0  Not at all
1  A little
2  A lot

1. Lack of familial or peer support
2. Concerns about doing it “right”
3. Physical pain or discomfort
4. Too many distractions
5. Mind-wandering
6. Lack of time
7. Boredom
8. Fatigue
9. Too distressed
10. Breaks in routine (e.g., vacation)
11. Other
Appendix F

Mindfulness Self-Efficacy (MSE) Scale

Using the scale below, please indicate how confident you are that you can complete the following tasks. A score of 100 per cent confidence indicates that you are completely confident that you can complete the task (e.g. 100 per cent confidence that you can brush your teeth). A score of 0 per cent confidence indicates that you do not believe you can accomplish the task at all (e.g. 0 per cent confidence that you can jump 10 feet in the air).

<table>
<thead>
<tr>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100 (%)</th>
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<tbody>
<tr>
<td>No confidence</td>
<td>Moderate confidence</td>
<td>Complete confidence</td>
<td></td>
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</tbody>
</table>

I. How confident are you that your ability to maintain moment to moment non-judgmental awareness will keep you peaceful:

1. When you must wait on an express line in a supermarket because shoppers with too many items are ahead of you.

2. When you are hungry and see yourself reaching for junk food.

3. When you do not have enough free time for yourself.

4. When your boss gives you extra work at the end of the day.

5. When someone you love hurts you deeply.

6. When you have a fight with your significant other.

7. While you are experiencing fatigue and still have six more hours of work.

8. While you are experiencing pain of five on a scale of 1 to 10.

9. While you are experiencing pain of eight on a scale of 1 to 10.

10. When you have difficulty sleeping and have an important meeting the next day.

11. When your physician is telling you that the result of a test does not look good.
12. When your boss is telling you that you have done a task incorrectly.

13. When your significant other is criticizing a bad habit of yours.

14. While you are stuck in a traffic jam on a day off from work.

15. When you are stuck in a morning traffic jam and you are already late for work.

II. At this moment how confident are you that:

1. You can practice the sitting meditation for at least 30 uninterrupted minutes.

2. You can practice the sitting meditation 6 days a week for at least 30 uninterrupted minutes each day.

3. You can practice the sitting meditation for at least 30 uninterrupted minutes on a day that you wake up late.

4. You can practice the sitting meditation for at least 30 uninterrupted minutes on a day after a bad fight with a friend or significant other.

5. You can practice the sitting meditation for at least 30 uninterrupted minutes on the day you know you will have to work significant overtime.

6. You can practice the sitting meditation for at least 30 uninterrupted minutes when experiencing pain of five on a scale of 1 to 10.

7. You can practice the sitting meditation for at least 30 uninterrupted minutes when experiencing pain of eight on a scale of 1 to 10.
Appendix G

Multidimensional Health Locus of Control, form A (MHLC-A)

Instructions: Each item below is a belief statement about your medical condition with which you may agree or disagree. For each item we would like you to select the number that represents the extent to which you agree or disagree with that statement. This is a measure of your personal beliefs; obviously, there are no right or wrong answers.

1 Strongly Disagree
2 Moderately Disagree
3 Slightly disagree
4 Slightly agree
5 Moderately agree
6 Strongly agree

1. If I get sick, it is my own behavior that determines how soon I get well again.

2. No matter what I do, if I am going to get sick, I will get sick.

3. Having regular contact with my physician is the best way for me to avoid illness.

4. Most things that affect my health happen to me by accident.

5. Whenever I don’t feel well, I should consult a medically trained professional.

6. I am in control of my health.

7. My family has a lot to do with my becoming sick or staying healthy.

8. When I get sick, I am to blame.

9. Luck plays a big part in determining how soon I will recover from an illness.

10. Health professionals control my health

11. My good health is largely a matter of good fortune.
12. The main thing that affects my health is what I myself do.

13. If I take care of myself, I can avoid illness.

14. Whenever I recover from an illness, it's usually because other people (for example, doctors, nurses, family, friends) have been taking good care of me.

15. No matter what I do, I'm likely to get sick.

16. If it's meant to be, I will stay healthy.

17. If I take the right actions, I can stay healthy.

18. Regarding my health, I can only do what my doctors tell me to do.
Appendix H

Marlowe-Crowne Social Desirability Scale, short form C

Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to you.

True
False

1. It is sometimes hard for me to go on with my work if I am not encouraged.

2. I sometimes feel resentful when I don’t get my own way.

3. On a few occasions, I have given up doing something because I thought too little of my ability.

4. There have been times when I felt like rebelling against people in authority even though I knew they were right.

5. No matter whom I’m talking to, I’m always a good listener.

6. There have been occasions when I took advantage of someone.

7. I’m always willing to admit it when I make a mistake.

8. I sometimes try to get even, rather than forgive and forget.

9. I am always courteous, even to people who are disagreeable.

10. I have never been irked when people expressed ideas very different from my own.

11. There have been times when I was quite jealous of the good fortune of others.

12. I am sometimes irritated by people who ask favors of me.

13. I have never deliberately said something that hurt someone’s feelings.
Appendix I

Self-Compassion Scale, short form (SCS-SF)

Please read each statement carefully before answering. To the left of each item, indicate how often you behave in the stated manner, using the following scale:

1. Almost Never
2. Rarely
3. Sometimes
4. Often
5. Almost Always

1. When I fail at something important to me I become consumed by feelings of inadequacy.
2. I try to be understanding and patient towards those aspects of my personality I don’t like.
3. When something painful happens I try to take a balanced view of the situation.
4. When I’m feeling down, I tend to feel like most other people are probably happier than I am.
5. I try to see my failings as part of the human condition.
6. When I’m going through a very hard time, I give myself the caring and tenderness I need.
7. When something upsets me I try to keep my emotions in balance.
8. When I fail at something that’s important to me, I tend to feel alone in my failure.
9. When I’m feeling down I tend to obsess and fixate on everything that’s wrong.
10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.
12. I’m disapproving and judgmental about my own flaws and inadequacies.

13. I’m intolerant and impatient towards those aspects of my personality I don’t like.
Appendix J

Mindful Attention Awareness Scale (MAAS)

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1. I could be experiencing some emotion and not be conscious of it until sometime later.

2. I break or spill things because of carelessness, not paying attention, or thinking of something else.

3. I find it difficult to stay focused on what's happening in the present.

4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.

5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.

6. I forget a person's name almost as soon as I've been told it for the first time.

7. It seems I am "running on automatic," without much awareness of what I'm doing.

8. I rush through activities without being really attentive to them.

9. I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.
10. I do jobs or tasks automatically, without being aware of what I’m doing.

11. I find myself listening to someone with one ear, doing something else at the same time.

12. I drive places on "automatic pilot" and then wonder why I went there.

13. I find myself preoccupied with the future or the past.


15. I snack without being aware that I’m eating.
Appendix K

Practice Quality-Mindfulness (PQ-M)

With respect to today’s session, please indicate the approximate percentage (0-100) of time that your experience reflected each statement below.

0%-----10%-----20%-----30%-----40%-----50%-----60%-----70%-----80%-----90%-----100%

1. During practice, I attempted to return to my present-moment experience, whether pleasant, unpleasant, or neutral.

2. During practice, I attempted to return to each experience, no matter how unpleasant, with a sense that “It’s OK to experience this”.

3. During practice, I attempted to feel each experience as bare sensations in the body (tension in throat, movement in belly, etc).

4. During practice, I was struggling against having certain experiences (e.g., unpleasant thoughts, emotions, and/or bodily sensations).

5. During practice, I was actively avoiding or “pushing away” certain experiences.

6. During practice, I was actively trying to fix or change certain experiencing, in order to get to a “better place”.
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Biography

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List of publications

