Impacts of Stress and Therapy Homework on Momentary Assessments of Positive and Negative

by

Katherine Gardhouse

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Graduate Department of Psychological Clinical Science

University of Toronto

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Abstract

The recurrent nature of major depressive disorder exacts a hefty toll on society. It is thus important to understand what experiences lead to better outcomes post treatment. The present study examined the relationship between individual differences in stress-linked affect regulation and clinical symptoms in remitted depressed patients after the completion of group cognitive behaviour therapy or mindfulness based cognitive therapy. The Experience Sampling Method (ESM) was used to capture the daily experience of 47 remitted depressed patients (mean age = 37.40, SD = 10.93; 72% women) over a one-year follow-up. While negative affect was found to significantly predict depressive symptoms over the year, the frequency of formal homework practice reduced the impact of stress on negative affect, providing protective benefit. Additionally, experience of positive affect dampened the amount of dysfunctional thinking activated under high moments of stress. This research indicates the benefits of formal homework practice during prophylactic treatment.
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Chapter 1
Affective Response under Stress in Major Depressive Disorder

Major depressive disorder (MDD) remains a daunting mental health challenge with lifetime risk at 16-19% (Kessler et al., 1994; Kessler, Berglund, Demler, Jin, & Walters, 2005). Despite marked success in treating active individual episodes of unipolar depression, there is a growing consensus that the outcome for patients following acute treatment is relatively poor unless the ongoing risk for episode relapse or recurrence is addressed (Teasdale et al., 2000; Teasdale et al., 2002; Conradi, Ormel, & de Jonge, 2011; Zajecka, Kornstein, & Blier, 2013). Relapse risk increases by 16-18% after each subsequent episode (Mueller et al., 1999), and understanding what elements of experience (e.g. fluctuations in daily mood) make individuals so highly vulnerable will play an essential role in reducing the burden of MDD, which is now a leading cause of disability worldwide (Marcus, Yasamy, Ommeren, Chisholm, & Saxena, 2012).

To date, numerous interventions have been developed to target some of the automatic and negative thought patterns that are known to be a risk factor for future relapse; and following the completion of such interventions, there is enormous social and economic benefit in understanding the pattern of responses that prevent relapse and keep individuals well after recovery.

Episodes of major depressive disorder (MDD) are commonly, although not exclusively, precipitated by stressful life events (Hooley, Orley, & Teasdale, 1986; Kessler, 1997; Mazure, Bruce, Maciejewski, & Jacobs, 2000; Kendler, Thornton, & Gardner, 2001; Pollock, 2001; Bulmash, Harkness, Stewart, & Bagby, 2009); however, in line with the diathesis-stress model, it is not the level of stress per se, but the ease of which dysfunctional thinking patterns are activated in response to stress that encompass the vulnerability of remitted depressed patients.
Eberhart, Auerbach, Bigda-Peyton, & Abela, 2011). It has been posited that even though many of the dysfunctional thinking patterns that are commonly reported in clinical depression lie dormant during remission, these dysfunctional modes of thinking are readily primed in response to stressors, leaving previously depressed individuals highly vulnerable to future relapse (Kovacs & Beck, 1978; Hollon, Stewart, & Strunk, 2006). For example, Segal et al. (2006) followed remitted depressed patients over an 18-month period after they completed either cognitive behaviour therapy (CBT) or pharmacotherapy and found that cognitive reactivity in response to a brief sad mood provocation, administered post intervention, predicted relapse in these patients who were all seemingly well at the time of the mood induction. Furthermore, participants in the study who had completed CBT—and were thus exposed to skills designed to address depressive thinking patterns—demonstrated less cognitive reactivity to the sad mood provocation compared to those treated with drug therapy (Segal et al., 2006). The authors suggest that although dysfunctional thinking patterns may diminish following intervention, when these cognitions are easily activated in an individual, they serve as an important trigger for future relapse.

While the mood induction in Segal et al. (2006) asked participants to recall a major difficult event that had occurred in their lives while listening to sad-inducing music, it has also been posited that more minor day-to-day perturbations play a contributing role in the high levels of vulnerability found in this population (Butzlaff & Hooley, 1998; Vaughn & Leff, 1976; Dohrenwend, Shrout, Link, Skodol, & Stueve, 1995; Paykel, 1978; Silk, Steinberg, & Morris, 2003; Myin-Germey et al., 2003; Moberly & Watkins, 2008). Studies have found that day-to-day challenges often activate ineffective coping strategies (e.g. rumination, avoidance) that increase negative affect and overall depressive symptomatology in depressed individuals compared to healthy controls (Moberly & Watkins, 2008; Silk, Steinberg, & Morris, 2003;
Myin-Germeys et al., 2003). The response to these moment-to-moment triggers is hypothesized to be an important underlying factor in the maintenance of the disorder (Butzlaff & Hooley, 1998; Vaughn & Leff, 1976; Dohrenwend, Shrout, Link, Skodol, & Stueve, 1995; Paykel, 1978; Silk, Steinberg, & Morris, 2003; Myin-Germeys et al., 2003; Moberly & Watkins, 2008), and could also serve to undermine the protection afforded by learned skills and the emotional equilibrium achieved post intervention (Geschwind, Peeters, Drukker, Os, & Wichers, 2011).

Unpacking how individuals respond emotionally to demands and events in their environment has important implications for clinical intervention as affective responses in daily life have been found to reliably predict vulnerability and relapse (e.g. Geschwind, Peeters, Drukker, Wichers, & van Os, 2011; Michalak, Holz, & Teisman, 2011). For example, while negative affect (NA) is known to characterize acute phases of depression, these feeling states reliably decrease during remission (Scher, Ingram, & Segal, 2005). Returning to equilibrium, remitted depressed patients report decreases in NA and increases in positive affect (PA) after being treated with pharmacotherapy (Geschwind, Nicolson, et al., 2011) or mindfulness-based cognitive therapy (MBCT) (Geschwind, Peeters, Drukker, Os, & Wichers, 2011). Of note, the gains in PA in these studies were significantly higher than could be accounted for by the change in NA (Geschwind, Nicolson, et al., 2011; Geschwind, Peeters, Drukker, Os, & Wichers, 2011). These increases in PA were associated with a reduction of symptoms, and the authors suggest that PA may provide protective benefit against the return of a depressive episode (Geschwind, Nicolson, et al., 2011).

In general, it has been demonstrated that PA and NA, while moderately negatively correlated (Crawford & Henry, 2004), are independent mood dimensions, as opposed to being polar opposites on the same vector (Clark, Watson, & Mineka, 2000; Gable, Reis, & Elliot,
In healthy populations, negative and stressful events have been shown to lead to increases in NA (Gable, Reis, & Elliot, 2000; Marco, Neale, Schwartz, Shiffman, & Stone, 1999; Suls, Green, & Hillis, 1998; van Eck, Nicolson, & Berkhof, 1998), whereas PA is less affected (David, Green, Martin, & Suls, 1997; Gable et al., 2000; van Eck et al., 1998). Instead, in healthy populations, PA is more reliably influenced by positive events in life (David et al., 1997; Gable et al., 2000; Langston, 1994). However, in depressed populations, NA tends to increase and PA substantially decreases (Clark, Beck, & Stewart, 1990; Jolly, Murray, Kramer, & Wherry, 1994; Watson et al., 1995). In fact, it is the substantial decreases in PA (and increased anhedonia) that are most pronounced in major depressive disorder, and reliably differentiate depression from commonly comorbid experiences of anxiety (Crawford & Henry, 2004). In remission, however, levels of PA tend to return to baseline (Bylsma, Taylor-Clift, & Rottenberg, 2011; Geschwind, Peeters, Drukker, van Os, & Wichers, 2011; Geschwind et al., 2010; Wichers et al., 2010), as do dysfunctional thought patterns and NA (Scher, Ingram, & Segal, 2005; Moberly & Watkins, 2008; Silk, Steinberg, & Morris, 2003; Myin-Germeyns et al., 2003). These findings, however, leave unanswered the question of whether changes in mood dynamics (i.e. increases in PA and decreases in NA) are maintained in the face of stressors that are known to trigger dysfunctional cognitions and clinical symptoms that support the chronic course of the illness.

To capture these experiential nuances, psychological research is now being extended beyond the confines of the lab to include situated approaches, investigating experiences directly within the context in which they occur (Csikszentmihalyi, & Larson, 1987; Csikszentmihalyi & Larson, 1992; Quen & Van Den Bergh, 2004; Hektner, Schmidt, & Csikszentmihalyi, 2007). While standard self-report questionnaires and interviews used to measure depressive symptoms...
provide an overall index of psychological functioning, they rely on retrospective inference from participants that may under-represent or bias the person’s overall state (Kahneman, 2000; Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). Increasingly, the use of ecologically valid methods—such as the experience sampling method (ESM)—that survey the psychological states of individuals in their daily lives are becoming an important tool to reliably evaluate patterns of risk in MDD.

To gain insight into the mechanisms that lead to relapse or recovery, the present study followed 49 remitted depressed participants over the course of a year using ESM to evaluate patterns of affect regulation in response to daily stress and overall depressive symptomatology. In line with the diathesis-stress model, it is hypothesized that higher levels of NA, and lower levels of PA are expected to predict clinical course (e.g. depressive symptoms) over the one year follow up. Furthermore, individuals who report high levels of dysfunctional thinking under stress are predicted to demonstrate patterns of affect similar to depressed populations (e.g. high NA and low PA) (Segal et al., 2006; Eberhart, Auerbach, Bigda-Peyton, & Abela, 2011; Geschwind, Peeters, Drukker, Os, & Wichers, 2011; Moberly & Watkins, 2009; Silk, Steinberg, & Morris, 2003; Myin-Germeys et al., 2003).

The participants in this study will have completed an eight week intervention in either cognitive behaviour therapy (CBT) or mindfulness based cognitive therapy (MBCT) before ESM follow-up. There is good evidence that psychological therapies, such as CBT and MBCT, teach patients skills for adaptive emotion regulation that can cause reductions in NA, rumination, and increases in PA (Michalak, Heidenreich, Meibert, & Schulte, 2008; Geschwind, Peeters, Drukker, Os, & Wichers, 2011). As such, we hypothesize that the consolidation of therapy skills, measured via homework practice, will influence response to stress. To assess these hypotheses
specifically, levels of PA and NA will be assessed in response to momentary levels of stress, dysfunctional thinking, and overall depressive symptom burden. Further analyses will determine if homework practice, during course intervention, buffers emotional responses over the follow-up.

**Intervention Homework**

Due to the fact that all participants in the current study received either CBT or MBCT before entering clinical follow-up, it is hypothesized that the degree to which therapy skills were practiced may be related to the level of stress reactivity. Both CBT and MBCT assign specific homework for the purposes of generalizing in-therapy learning to everyday life. Assigned homework is intended to test out thought patterns, increase engagement, and develop metacognitive skills that allow an observational stance to be brought to experiences that occur outside the therapist’s office (Beck, Rush, Shaw, & Emery, 1979; Segal, Williams, & Teasdale, 2002). The role of homework is thought to be so critical that participants are explicitly informed of the expectations and time commitment before they consent to start the intervention. This is done to prepare them for the workload and emphasize the active role they are expected to play. Many studies have assessed the effect of homework on treatment outcome in CBT and MBCT (Persons, Davidson, & Tompkins, 2001; Kazantzis, Whittington, & Dattilio, 2010; Nelson, Castonguay, & Barwick, 2007; Neimeyer, Kazantzis, Kassler, Baker, & Fletcher, 2008; Vettese, Toneatto, Stea, Nguyen, and Wang, 2009; Perich, Manicavasagar, Michell, & Ball, 2009; Hawley et al., 2013; Crane et al., 2014). While some studies have used correlational analyses to assess the relationship between homework and outcome (e.g., Coon & Thompson, 2003), others have demonstrated a causal effect using a randomized control design with a homework condition.
versus a no-homework control group (e.g., Neimeyer & Feixas, 1990; Coon & Thompson, 2003; Rees, McEvoy, Nathan, 2004).

In a review of the research on correlational homework studies in CBT, Lambert et al. (2007) found that adherence to homework had a small to medium effect size on treatment outcome. While in general the impacts of homework have been mixed (Zettle & Hayes, 1987; Rees, McEvoy, Nathan, 2004; Detweiler-Bedell, & Whisman, 2005), a recent meta-analysis on only experimentally manipulated homework studies found that 62% of patients improve with CBT homework, while only 38% improve in non-homework conditions (Kazantzis, Whittington, & Dattilio, 2010). From this analysis it would seem that there is a benefit to the inclusion of homework during the course of intervention, and that homework may play a role in outcome (although participant factors, such as conscientiousness, were not controlled for).

Similarly, in MBCT home meditation practices are assumed to offer protection against relapse by fostering meta-awareness towards negative experiences (Segal, Williams, & Teasdale, 2013). As such, it would be expected that homework practice would influence the outcome of MBCT intervention. To date, the research on home practice in MBCT is sparse. In a review of 90 mindfulness based interventions, Vettese, Toneatto, Stea, Nguyen, and Wang (2009) found that only 24 studies had examined the role of homework, 13 of which found a positive relationship between homework and treatment outcome. The majority of these studies were not on MBCT specifically, and they were composed of a wide range of populations (e.g. pain, cancer, HIV, etc.) and a wide range of methodologies (e.g. ESM, retrospective self-report, frequency per week vs. duration in minutes). However, a recent study looking specifically at the role of homework practice in MBCT found that participant engagement in formal homework practices (e.g. sitting meditation, walking meditation, body scan, yoga) was associated with lower depressive
symptoms over a one year follow-up, and that those who engaged in formal practices at least three days per week during the eight-week intervention were 50% less likely to relapse over the year (Crane et al., 2014). This effect was maintained even after controlling for participant belief in the intervention (e.g. how credible they feel the intervention is, or how well they feel it suits their needs). This is important because positive beliefs about intervention have a strong impact on treatment outcome (Fennell & Teasdale, 1987; Iacoviello et al., 2007; Flückiger, Del Re, Wampold, Symonds, & Horvath, 2012; Kwan, Dimidjian, & Rizvi, 2010). Someone who is optimistic about a given intervention is likely to be more motivated, and may adhere to the homework more readily; or perhaps, their enthusiasm and perceived congruence with the intervention is enough to instigate change, regardless of homework practice. In Crane et al. (2014), participants’ ratings of treatment plausibility were not associated with the amount of homework practice, suggesting the role of homework was an essential component of the change process.

Conceptually, the home practices utilized in MBCT can be separated into either formal or informal categories. They can also be measured by either frequency (number of times per week) or duration (minutes/hours per day). At present, there is no standard metric for measuring home practices, nor is there consensus as to whether duration or frequency is most important to clinical outcome. Perich, Manicavasagar, Michell, and Ball (2013) measured the cumulative number of formal practices in a sample of bipolar patients receiving MBCT, and found that there was a significant relationship between the total number of days of practice and levels of depression over a twelve month follow-up. Similar to Crane et al. (2014), they found that individuals who practiced on average greater than three times per week reported lower levels of depression and anxiety compared to those below the threshold. Lastly, a study by Hawley et al. (2014) found
that the amount of formal, but not informal, homework practice in either MBCT or mindfulness based stress reduction (MBSR) predicted lower Hamilton Depression Rating scores, and that this was partly mediated by reductions in rumination.

While there have not yet been any experimental manipulations of homework in MBCT, so far it appears that the homework practices in both MBCT and CBT contribute to positive outcomes. These practices help participants change and relate to their thoughts, and it is these changes that are hypothesized to play a critical role in proximal affect regulation as well as more distal prevention of relapse (Beck, Rush, Shaw, & Emery, 1979; Segal, Williams, & Teasdale, 2002). As such, a significant relationship between the amount of homework and symptom burden would be expected. To assess the role of homework practice, the current study will examine the impact of homework adherence on clinical course. Levels of homework were monitored during the eight week CBT and MBCT protocols, providing data that can be used to assess the impact of therapy skills on daily experience and long-term outcome. Increased homework, measured in time and frequency, is expected to lead to greater resiliency over the follow-up period, and may also mitigate the effects of stress on affect regulation measured via ESM.

To our knowledge, the current research is the first to look at response patterns to daily levels of stress using a longitudinal design in remitted depressed patients. This framework will connect momentary experience of positive and negative affect with levels of depressive symptoms and help to explain how stress contributes to these relationships. Identifying effective affect regulation in the presence of life stress has the potential to illuminate critical skills that patients require to get well and stay well.

Hypotheses
In line with previous research that has featured a diathesis-stress model of depression (Clark, Beck, & Stewart, 1990; Jolly, Murray, Kramer, & Wherry, 1994; Watson et al., 1995; Silk, Steinberg, & Morris, 2003; Myin-Germeyys et al., 2003; Crawford & Henry, 2004; Scher, Ingram, & Segal, 2005; Moberly & Watkins, 2008; Geschwind et al., 2010; Wichers et al., 2010; Bylsma, Taylor-Clift, & Rottenberg, 2011; Geschwind, Peeters, Drukker, van Os, & Wichers, 2011), it is hypothesized that high levels of stress and dysfunctional thinking will predict more typical characteristics of depressive affect including high NA and low PA, and that these affective states will predict clinical severity over the year of follow-up. Conversely, individuals who show less dysfunctional thinking under stress are expected to present affective patterns more typical of healthy populations, including muted NA and increased PA (Silk, Steinberg, & Morris, 2003; Myin-Germeyys et al., 2003; Peeters, Nicolson, Berkhof, Delespaul, & deVries, 2003; Segal et al., 2006; Moberly & Watkins, 2009; Geschwind, Peeters, Drukker, van Os, & Wichers, 2011). To directly assess these hypotheses, PA and NA will be assessed in response to momentary levels of stress. In conjunction with this, the role of homework practice will be used to assess whether skills practiced during treatment alter responses to stress that lead to resiliency.

Hypothesis 1: Over the year follow-up, participants who report higher levels of NA will also endorse higher levels of depressive symptom severity. Furthermore, in line with cognitive models of depression (Beck, 1995/2010), high levels of NA will be influenced by momentary stress and dysfunctional thinking such that dysfunctional thinking will heighten NA under stressful situations. Probes that assess NA are expected to correlate positively with symptoms of depression, stress, and dysfunctional thinking.

Hypothesis 2: Over the one year follow-up, participants who report higher levels of PA in daily life are expected to demonstrate more resiliency. Probes that assess PA are expected to
fluctuate negatively with symptoms of depression and stress. Furthermore dysfunctional thinking is expected to moderate levels of PA in response to stress. As such, higher levels of dysfunctional thinking are expected to reduce levels of PA at high levels of stress.

Hypothesis 3: Homework practice will be measured in both time and frequency each day for seven weeks over the course of each intervention. It is expected that greater levels of homework practice will temper the relationship between stress and negative affect. Furthermore, homework practice is expected to mute the impacts of stress on PA. Both formal and informal homework practices will be assessed. The relationship between the amount of formal and informal homework, stress, and affective responses will be assessed using an average daily homework variable collected over the seven weeks embedded within the eight week treatment.

Chapter 2

Methods

Participants

As part of a larger neuroimaging study called the Mood Balance Project (MBP), 161 participants were recruited for enrollment through the Centre for Addiction and Mental Health in Toronto, Canada. The ESM component of the MBP was based on a subsample of these participants ($N = 49$; see Table 1 for demographics and clinical characteristics). Participants who were enrolled in the MBP had previously experienced at least one episode of MDD. Individuals were excluded if they were experiencing a full episode of major depression at the time of study, or met diagnostic criteria for schizophrenia or current psychosis; organic mental disorder or pervasive developmental disorder; current substance dependence; imminent suicide or homicide risk; an Axis I or II disorder that required primary treatment; or started or changed antidepressant medication within the eight weeks leading up to intervention.
The subset of participants who were invited to join the ESM arm of the study were those who participated in the final eight groups of the overall MBP. This is because ESM was added to the study at a later point in the protocol. Sixty-eight participants in total were asked to participate in the ESM research, 49 of whom agreed. Of the 49 participants, one individual dropped out because they were travelling during the year of sampling. Another participant’s data was lost. Of the remaining 47 participants (see Table 2 for demographics), only those that had a greater than 30% response rate for a given week were included in the analyses to maintain reliability (Delespaul, 1995; Palmier-Claus et al., 2011), which resulted in a final sample of 42 participants. Of these participants with greater than 30% data, 18 completed three weeks with sufficient data, 16 completed two weeks of sufficient data, and 8 completed only one week of sufficient data (for a total of 95 weeks of data and 1071 occasion measures). Sixteen of the lost weeks were due to equipment failure, 9 were due to low response rates, and six were due to participant drop-out/loss of contact at the second (n =1) and third (n = 5) round of collection (no reason was provided for drop-out).

**Procedures**

All study procedures were approved by the Centre for Addiction and Mental Health and the University of Toronto, and all participants gave informed consent before beginning the study. Participants were screened using the Structured Clinical Interview for DSM-IV (SCID-IV) (First & Gibbon, 2004) and the Hamilton Depression Rating Scale (HDRS). After baseline assessment, participants were randomized to either MBCT (N = 86), or group CBT (N = 75). Group sizes ranged from eight to twelve participants. After completing eight weeks of either intervention, 49 participants agreed to take part in three separate experience sampling sessions that were one week in duration and spaced apart at three, six, and twelve months post intervention. Palm-top
devices were couriered to their address at each time interval (three, six, and twelve months), and participants were instructed to carry the device with them for the week while responding to as many prompts as possible each day. In parallel, HDRS interviews were done via phone every 2 months for the follow-up year to track overall symptom burden. During the months that phone interviews were not collected, online measures were completed by participants to continue to track their mood.

Experience Sampling Method (ESM). The experience sampling method is an ecologically valid assessment that permits momentary recording of participants’ experience in their daily life (Csikszentmihalyi & Larson, 1992; Hektner, Schmidt, & Csikszentmihalyi, 2007). In the current study, participants received a personal electronic device to carry with them for three one-week periods at month three, six, and twelve post intervention. Items on the device were selected to tap into domains of positive and negative affective states, stress, and dysfunctional thinking, which have been linked to a propensity for depressive relapse (Geschwind, Peeters, Drukker, Wichers, & van Os, 2011; Michalak, Hölz, & Teismann, 2011; Brown & Ryan, 2003; Moberly & Watkins, 2008; Silk, Steinberg, & Morris, 2003; Myin-Germeys et al., 2003). Participants were asked to respond to as many prompts as possible throughout each week long period. Each day, the device would emit a prompt (by vibrating, flashing, and beeping) at three random times between 9am and 9pm (with no two prompts occurring within 90 minutes of one another). When the device prompted them, participants were invited to respond by answering a series of 13 questions using a Likert sliding scale on the touch screen, responding to a maximum of 21 prompts over the week. Probes of interest to the current research tapped into domains of positive and negative mood (e.g. How EXCITED are you...
feeling right now? How GUILTY are you feeling right now?), dysfunctional thinking (e.g. “I feel like a loser”, “I feel rejected.”), and momentary levels of stress (see Table 3).

The Likert scale for each question ranged from “Not at all” to “Extremely” and is represented by a horizontal sliding scale on the touch screen. The default position of the indicator begins at the center of the scale (a score of 50) and participants can slide the indicator left towards “Not at all” (a score of 0), or right towards “Extremely” (a score of 100) in response to each question. To ensure responses were reflective of momentary situations, participants had 60 seconds to respond to the prompt before the device returns to its ‘sleeping’ mode. While previous ESM studies have utilized pen and paper methods of data collection (Geschwind, Peeters, Drukker, van Os, & Wichers, 2011; Geschwind et al., 2010; Wichers et al., 2010), the use of an electronic device in the current study increased the reliability of ESM as participants must respond immediately, effectively eliminating memory distortion. Of course, life activities throughout the week likely prevented participants from being able to respond to every single prompt (e.g. when driving, or in an important meeting), thus a full set of 21 responses was not anticipated. However, weeks that fell below a threshold of 30% completion were excluded to ensure that participants’ experiences were reliably captured across each week (Delespaul, 1995; Geschwind, Peeters, Drukker, van Os, & Wichers, 2011; Geschwind et al., 2010; Wichers et al., 2010).

Treatment

**Mindfulness Based Cognitive Therapy (MBCT).** MBCT was provided in group format for a total of eight weekly two hour sessions according to the protocol outlined by Segal, Williams, and Teasdale (2002). Each group had an average of twelve participants, as recommended by the protocol. Mindfulness was taught through eating, sitting, lying, and
walking meditations, as well as gentle yoga practices. The program included 45 minutes of daily homework with CD-guided and self-guided mindfulness practices. These are designed to increase moment by moment nonjudgmental awareness of bodily sensations, thoughts, and feelings, together with the application of awareness skills in daily life. A goal of MBCT is that participants learn to adopt a metacognitive perspective to their thoughts and feelings, in which these are viewed as passing events in the mind. Participants are encouraged to cultivate an acceptant response to experience and intentionally face difficulties and discomfort instead of actively trying to avoid or change them.

**Cognitive Behaviour Therapy (CBT).** CBT was delivered within the Well-Being framework outlined by Fava, Rafanelli, Cazzaro, and Grand (1998) and, as codified by A.T. Beck et al., (1979) and J. S. Beck (2010). In-group sessions had an average of eight participants per group. Strategies and techniques were used to help participants increase activating and pleasurable activities, identify cognitive distortions, respond to negative thinking and underlying dysfunctional beliefs, as well as increase routines of self-care, sleep and energy regulation. Participants completed daily homework and thought records to assess their cognitions and behaviours.

**Measures**

**Clinical symptoms.** Given the past history of depression in the current sample, and the fact that previous depressive episodes and residual symptoms of depression are associated with a higher risk of relapse (Judd et al., 1998; Zajecka, Kornstein, & Blier, 2013), it is expected that some participants will maintain remission, while others may relapse or experience residual symptoms. To assess symptom severity the Hamilton Depression Rating Scale was used (Hamilton, 1960). The HDRS is a semi-structured interview designed to evaluate depressive
symptoms over the past week. The HDRS is one of the most commonly used interviews for major depression with high internal reliability estimates (Bagby, Ryder, Schuller, & Marshall, 2004). The HDRS was collected via phone interview at months two, four, eight, and twelve. All interviews were administered by a trained research assistant. When a participant presented two consecutive weeks of elevated HDRS scores, the SCID-IV Axis I interview (First, Spitzer, Gibbon, & Williams, 1997) was used to determine if a full relapse had occurred.

While it is expected that some percentage of individuals will meet full diagnostic criteria for a major depressive episode (>12.0), participants who do not meet full diagnosis will also be stratified according to the degree of their depressive severity. Participants who do not relapse will be categorized into either a “remission” or “residual” symptom group. “Residual” symptoms are operationalized as individuals with HDRS scores between 7.0 - 12.0. Scores below 7.0 on the HDRS were categorized as “remission”. This stratification is necessary as it would be inappropriate to lump individuals in the gray area of “residual” into the remission group, as these individuals are considered highly vulnerable for future relapse (Keller et al., 1987; Conradi, Ormel, & de Jonge, 2011; Zajecka, Kornstein, & Blier, 2013). Residual depressive symptoms (RDS), defined as the persistence of subthreshold symptomatology following acute phase treatment, are increasingly recognized as indicators of negative prognosis and are important treatment targets in their own right (Paykel, 2008). As such, these three groupings (remission, residual, and relapse) all hold valuable information in understanding affect regulation strategies that coincide with depressive severity and stress.

In addition to the HDRS, online measures of the Quick Inventory of Depressive Symptomatology (QIDS-SR) (Rush et al., 2003) were measured at months two, six, ten, and twelve. In reference to the ESM time points, months two, six, and twelve will be included as
outcome measures approximately corresponding to the weekly ESM assessments. The QIDS-SR is a 16 item self-report inventory that covers the nine diagnostic symptom domains used to characterize MDD. Participants respond to each item using a Likert scale (0-3) that estimates the severity of symptoms.

**PANAS.** Positive and negative probes were taken from the Positive Affect Negative Affect Scale (PANAS) (Watson & Clark, 1994) such that each probe includes two randomly selected positive, and two randomly selected negative affect questions. The PANAS was selected due to its ability to target specific profiles of depression (Crawford & Henry, 2004), and because of similar variable inclusion in relevant ESM studies (Moberly & Watkins, 2008; Wichers et al., 2007; Geschwind et al., 2011).

**Homework and Skill Assessment.** Homework during the eight week interventions was monitored daily. Homework scales were specific to both CBT and MBCT and assessed direct adherence to homework during the intervention. During the CBT intervention, participants would indicate through daily self-report how often and how long in duration they practiced goal setting, thought records, cognitive restructuring, assertiveness, relaxation, and activity scheduling each day over the eight weeks. Similarly, in the MBCT groups, participants would indicate how often and how long in duration they practiced each day any sitting meditation, body scan, yoga, mindful walking, the three-minute breathing space, and everyday mindfulness.

While individual intervention skills are not yet being analyzed due to a two year blind on the intervention groups, homework skills have been broken down into two categories including formal homework practice and informal homework practice. Formal practices from CBT include weekly activity scheduling, goal setting, thought records, and cognitive restructuring. Similarly, formal homework practice in MBCT include sitting meditations, body scans, yoga, and mindful
walking. Informal CBT practices include assertiveness, and reducing anxiety activities, while MBCT informal practices include the three minute breathing space and everyday mindfulness activities (See Table 4). This breakdown amounted in four continuous homework indices of the time (in minutes) and frequency (number of times per day) of formal and informal practice. Single sessions of formal homework practice were capped at 45 minutes per day to correspond with the guided homework practices.

**Statistical Analyses**

Due to the fact that experience sampling occasions are nested within weeks, within participants, we estimated the effects of stress on mood states using multilevel linear regression modeling, which is a variant of multiple regression appropriate for hierarchical data. Multilevel modeling is required because mood will tend to be more similar if (a) taken at the same occasion in time (level 1), (b) taken within the same week (level 2), or (c) taken from one participant compared to another (level 3). To ignore the violation of independence assumption would bias the estimated standard errors of the regression coefficients and could inflate the effects of the predictor variables (Snijders & Bosker, 1999). When estimating the effect of stress, dysfunctional thinking, and homework on mood states, separate models for NA and PA were estimated using the MIXED procedure in IBM SPSS Statistic 22.0 software package. The basic form of the multilevel equation can be expressed as follows:

**Level-1 Model:**

\[ \text{Mood} = \pi_0 + \pi_1(L1\text{Stress}) + \pi_2(\text{Practice}) + \pi_3(L1\text{Stress} \times \text{Practice}) + e \]

**Level-2 Model:**

\[ \begin{align*}
\pi_0 &= \beta_{00} + \beta_{01}(L2\text{Stress}) + r_0 \\
\pi_1 &= \beta_{10} \\
\pi_2 &= \beta_{20} + \beta_{21}(L2\text{Stress}) \\
\pi_3 &= \beta_{30}
\end{align*} \]

**Level-3 Model:**

\[ \begin{align*}
\beta_{00} &= \gamma_{000} + u_{00} \\
\beta_{01} &= \gamma_{010} \\
\beta_{10} &= \gamma_{100}
\end{align*} \]
\[ \beta_{20} = \gamma_{200} \\
\beta_{21} = \gamma_{210} \\
\beta_{30} = \gamma_{300} \]

Or, in a simplified form:

\[ \text{Mood} = \gamma_{000} + \gamma_{100}(\text{L1Stress}) + \gamma_{010}(\text{L2 Stress}) + \gamma_{200}(\text{Practice}) + \gamma_{300}(\text{Stress} \times \text{Practice}) + \gamma_{210}(\text{L2Stress} \times \text{Practice}) + u_0 + \varepsilon \]

In the combined example equation above: \( \gamma_{000} \) is the overall intercept; \( \gamma_{100} \) is the slope for Level 1 Stress; \( \gamma_{010} \) is the slope for Level 2 Stress; \( \gamma_{200} \) is the slope for Practice; \( \gamma_{300} \) is the slope for the Level 1 interaction term (L1Stress \times Practice), and \( \gamma_{210} \) is the slope for the cross-level L1Stress \times Practice interaction; \( u_0 \), \( r_0 \) represent random (varying) components of the intercept, and \( \varepsilon \) represents residual error. All variables were grand mean centred within subjects to reduce multicollinearity and produce a more stable model (Hayes, 2006).

PA was normally distributed, while the remaining variables were positively skewed. However, after conducting a log transformation on the variables, \( p \) values were unaffected. As such, \( B \) values are reported from the original data as coefficients can be difficult to interpret after transformation. All a priori hypothesis significance tests were retained at an alpha = .05 level. Effects sizes for each multilevel model were calculated according to the method in Hayes (2006). This provides an overall \( R^2 \) for the entire model. To find this, the residual error for a given model of interest is divided by the residual error for a null model. This provides a proportion value representing the amount of variance accounted for by the model of interest.

Chapter 3

Results

Descriptive statistics. Descriptive variables were averaged to provide one value per participant. All means, standard deviations, and correlations are presented in Table 5.
scales were adjusted, mean values of NA and PA were found to be comparable to previous research in remitted depressed populations (Geschwind, Peeters, Drukker, Os, & Wichers, 2011; Geschwind, Nicolson, et al., 2011; Peeters, Nicolson, Berkhof, Delespaull, & deVries, 2003). Amount of homework practice was similar to past research on CBT (Kazantizis & Deane, 1999) and MBCT (Crane et al., 2014). NA and PA were moderately negatively correlated with one another. The correlation found between PA and NA is a replication of previous findings with the PANAS (Peeters, Nicolson, Berkhof, Delespaull, & deVries, 2003; Crawford & Henry, 2004). PA was also moderately negatively correlated with stress and dysfunctional thinking. NA, dysfunctional thinking, and stress were all strongly positively correlated with one another. Overall, participants reported high levels of stress, one standard deviation above the mean, at 230 different time points. All forms of homework practice, measured in duration and frequency, demonstrated small to medium positive correlations.

To assess whether the variables of interest do in fact violate the assumption of independence, and account for significant variance at each level of the model, an intraclass correlation (ICC) variable was calculated (Hayes, 2006). All ESM variables (NA, PA, Stress, and Dysfunctional Thinking) demonstrated a sufficient proportion of variance at each level of the model. As such, when using level two predictors, such as stress in our analyses, an average score across each week, within each person was calculated and centred. Due to the fact that homework practices were measured outside of ESM, variation in homework practice only occurred at level three. The final decision to utilize level 1 and 2 predictors, and level 1 (NA and PA), and level 2 dependent variables (HDRS and QIDS-SR) was determined by comparing the log-likelihoods of each model to determine which model best fit the data.
Mixed models. The multilevel models will provide information as to what protective benefits participants have gained as a result of intervention in terms of their responses to stress in daily life. The results of the mixed model regression for NA and PA are provided in Table 6. In the table, the B values are the fixed regression coefficients of the predictors in the mixed model and can be interpreted in a similar way as unstandardized estimates in multiple regression using the general linear model. The effects of stress, dysfunctional thinking and homework practice (IV) are assessed in relation to the various affective states (DV) reported below.

Positive affect. As hypothesized, the relationship between occasion level stress and positive affect was significant and negatively correlated. More specifically, momentary and weekly levels of stress (level 1 and 2) predicted PA. This means that a significant portion of the variability in PA at any given moment is accounted for by variance in momentary and weekly stress levels such that higher stress leads to lower PA. Similarly, momentary levels of dysfunctional thinking significantly predicted lower levels of PA. Dysfunctional thinking was also found to moderate the relationship between stress and PA such that individuals who exhibit higher levels of dysfunctional thinking show greater reductions in PA under high levels of stress (Figure 1). Only the frequency of formal homework practice significantly predicted PA, but in the unexpected direction. The correlation between PA and formal homework practice is very weak, but there is a negative relationship such that higher levels of formal home practice predict lower levels of PA. This model accounts for 13% of the variability in PA.

Negative Affect. Negative affect and stress at the occasion level were found to have a significant positive relationship such that increases in stress predict higher levels of negative affect. Similarly, dysfunctional thinking at the momentary and week level predicted higher levels of NA and moderated the relationship between stress and NA (Figure 2). In line with cognitive
models of depression, high levels of dysfunctional thinking led to higher levels of NA at both low and high moments of stress. There were no main effects of homework practice, but the frequency of formal homework practice significantly moderated the relationship between stress and NA such that individuals who practiced more frequently experienced less NA under stress (Figure 3). Overall, the model accounts for 45% of the variability in NA.

**Clinical Significance**

To assess the relationship between affect regulation in response to stress and overall depressive symptom burden, a model was created where the influence of NA and PA on overall symptom burden was evaluated in relation to stress. Three HDRS variables were represented. These included a continuous variable, a change from baseline score, and a three-level categorical group variable (i.e., 1 = remission, 2 = residual, and 3 = relapse). However, the current sample of participants showed almost no relapse or residual symptoms over the course of the year as measured by the HDRS. Of the 42 participants that were retained in the final analyses, only one experienced a full relapse (at 12 months), while six others reported elevated residual scores (e.g. HDRS 7.0 - 12.0) at month three (2 participants), six (1 participant), and twelve (3 participants). The average HDRS score of participants across the entire year was 2.0 with a standard deviation of 3.5.

To assess whether some individuals show a particular vulnerability pattern, raw scores of high and low dysfunctional thinking and stress were assessed. The diathesis stress model suggests that individuals who have elevated levels of dysfunctional thinking regardless of levels of stress are considered to be the most vulnerable to relapse (Eberhart, Auerbach, Bigda-Peyton, & Abela, 2011). As such, individuals who report dysfunctional thinking under low and high stress are expected to demonstrate increased symptom burden. To assess this, dysfunctional
thinking and stress scores that were above and below one standard deviation of the mean were compared. Remarkably, there were only two instances (out of 1071) where dysfunctional thinking was elevated during times of low stress. Additionally, moments of high stress and high dysfunctional thinking were also quite rare with only 24 instances of this more expected combination. These 24 instances were distributed amongst eight participants with a modal frequency of two time points per person where dysfunctional thinking and stress were high. The one individual who accounted for the majority of these 24 time points (11 in total), was the only participant who relapsed in the study. While this is an \( n = 1 \) finding, it certainly points to the relationship between dysfunctional thinking and relapse.

While the HDRS do not provide much variability for analyses, the QIDS-SR provides a more detailed range of symptom severity from low to severe symptom ratings. To assess the effect of NA and PA on the QIDS-SR, a two-level model was created to assess variability at the week level. While PA did not significantly predict QIDS-SR scores, variability in NA experienced across the week did predict higher symptom burden during the follow-up year. As hypothesized, individuals who experienced more NA exhibited more severe levels of depressive symptoms (Figure 4). Participants in this study will be followed for an additional year, and it will be interesting to evaluate whether individuals who express more NA in daily life, are more prone to relapse two years later.

Chapter 4

Discussion

A past history of MDD is known to be one of the strongest predictors for future relapse (Mueller et al., 1999). The present study followed a sample of participants with a prior history of depression after the completion of two efficacious treatments aimed to prevent future relapse—
CBT and MBCT. Although participants were not experiencing an episode of major depression when enrolled in the study, 9% had experienced one prior episode, 32% had experienced two prior episodes, while an additional 59% had experienced three or more past episodes. To determine how these at-risk individuals fared post intervention, the experience sampling method was employed to track daily responses to stress as they relate to clinical outcome. Although only one individual in the current sample experienced a full clinical relapse over the first year of follow-up, participants who expressed higher levels of NA in their daily life exhibited greater symptoms of depression across the year.

As one would expect, negative affect and stress were reliably positively associated such that high stress moments carried a high degree of NA. Furthermore, individuals who reported high levels of dysfunctional thinking (e.g. “I’m a loser”), also reported higher levels of NA that were more pronounced as stress increased. This is precisely the prediction made by cognitive theories of depression which hypothesize that an automatic interpretation occurs between an event and a person’s response in that situation (Beck, Rush, Shaw, & Emery, 1979). Previous studies that have utilized ESM with MDD have found that dysfunctional thinking patterns used to regulate affective states in day-to-day mood challenges are associated with daily increases in negative affect (NA) and overall depressive symptomatology (Moberly & Watkins, 2008; Silk, Steinberg, & Morris, 2003; Myin-Germeys et al., 2003). This finding was replicated in the current study. In our sample of remitted depressed patients, dysfunctional thinking contributed to negative affective states under stress which predicted depressive symptoms across the follow-up.

Importantly, although stress predictably influenced levels of NA overall, when individuals more frequently engaged in formal home practice during the course of intervention, the relationship between stress and NA was dampened. This interaction suggests that the
integration of skills during intervention can have important protective benefits, and demonstrates a similar pattern to past research that suggests that formal, and not informal, home practice is important to the change process (Crane et al., 2014; Hawley et al., 2014). The fact that this trend was found while keeping the same distinction of formal and informal practice across both MBCT and CBT suggests that these more deliberate practices apply to CBT as well. Overall, the findings suggest that homework can influence emotional response under stressful situations.

Our findings replicate past research that found that PA is less impacted by stressful events than NA (David, Green, Martin, & Suls, 1997; Gable et al., 2000; van Eck et al., 1998). Although individuals who report higher levels of PA also report less stress and dysfunctional thinking, this model accounted for only 13% of the variability in PA suggesting that PA is more heavily influenced by variables not accounted for in the model. Past research suggests that PA is more responsive to pleasant events in life, and while those moments were not captured by the ESM probes, perhaps positive events account for more of the variation found in PA. Future research may want to include more variables that detail the non-stressful moments in life to evaluate these patterns.

The findings of the present study are in line with previous research on MBCT and homework practice (Crane et al., 2014; Hawley et al., 2014; Perich et al., 2013), in the sense that formal, and not informal, homework practice influenced response to stress. However, unlike previous research, homework practice was not correlated with treatment outcome or affective states in daily life. While this is somewhat surprising, the fact that homework measures were only available at the participant level (level 3) (during intervention and not during follow up) may be too crude of a measure to relate to subsequent emotional states in momentary experience. However, ongoing data are being collected to track home practice maintenance over the follow-
up, and may provide more detailed information about the relationship between mood and practice as it occurs across the year.

Although, like Hawley et al. (2014) and Crane et al. (2014) no effects were found for informal practices, it is possible that this is due to measurement error, as informal practices are more difficult to capture when they are not carried out in a structured format, but are instead integrated into one’s daily life. Formal practices typically require participants to set aside a specific time to complete the task, whereas informal practices are meant to be utilized whenever the opportunity arises in the day, thus making the duration and frequency estimates more difficult to gauge. In the current study, informal homework included the three minute breathing space and everyday mindfulness from MBCT, and assertiveness training and anxiety reduction from CBT. While Crane et al. (2014) incorporated the three minute breathing space in formal practices, we felt that this skill is used more informally for brief moments when the participant deems it appropriate, regardless of whether they carry out the exercise for the entire three minutes. It is still debatable as to how these kinds of distinctions should be made, and ultimately, MBCT should be assessed under experimental homework conditions, just as CBT has been (Kazantzis, Whittington, & Dattilio, 2010), to determine the value of these therapy extensions.

The study design had a number of limitations that bear further discussion. Previous ESM research has found that participants respond within 20 minutes of the prompt, 85% of the time (e.g. Peeters, Nicolson, Berkhof, Delespaul, & deVries, 2003). However, the electronic design of the present study required participants to respond immediately (within 60 seconds), as capturing momentary experience, free of retrospective bias, was of particular importance to this project. As such, response rates were much lower than rates seen in other research. In comparison, response rates within 60 seconds were completed only 40% of the time. This difference is likely due to the
fact that participants have such a short window of time to respond to the device. To improve upon our design, when using electronic technologies for ESM, future research may want to allow a slightly longer window to respond (e.g. two minutes). This would give participants a little more time to dig through their bag to find the device, or stop what they are doing and turn their attention toward the prompt. Future studies will benefit from using participants’ own smartphones for ESM data collection, as most individuals are accustomed to responding to their phones frequently and would find carrying only one device more convenient.

Overall, the small sample size of our research limits the ability to look at patterns of responses across the day or week. Due to the fact that electronic ESM data collection is a relatively new approach, it was difficult to predict the level of response we would attain. In future, increasing both the number of probes per day, and the response time window would boost power. The decision to only probe participants three times per day (as opposed to the common 7-10 times per day) was made because of the longitudinal nature of this data set. To avoid response fatigue, and retain participants over the entire year, the decision was made to be less invasive each day but collect data over multiple weeks. However, this resulted in a lower number of daily responses, as the prompts were often missed.

As the use of technology increases, future research may want to investigate autonomic responses to stress to provide a biomarker of the effect of stress on affect regulation. Technologies that measure autonomic response, such as heart rate variability, are becoming commonly available with smartphone technology and would be a great adjunct to self-report measures in daily life. Integrating these kinds of innovative technologies in experience sampling research is now both plausible, and less invasive to participants than ever. The reliability and
detail provided by such methods absolutely increases our ability to capture experience more accurately than ever before, and provides an exciting new avenue for research in the world.
References


Iacoviello, B. M., McCarthy, K. S., Barrett, M. S., Rynn, M., Gallop, R., & Barber, J. P. (2007). Treatment preferences affect the therapeutic alliance: implications for randomized


### Table 1

**Participant Characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total sample N = 49</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>37 (10.93)</td>
</tr>
<tr>
<td><strong>Sex (women)</strong></td>
<td>72%</td>
</tr>
<tr>
<td><strong>Education Levels</strong></td>
<td></td>
</tr>
<tr>
<td>Completed high school</td>
<td>17%</td>
</tr>
<tr>
<td>College or University</td>
<td>74.5%</td>
</tr>
<tr>
<td>Graduate/Professional school</td>
<td>8.5%</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>78.7%</td>
</tr>
<tr>
<td>Asian</td>
<td>10.6%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2.1%</td>
</tr>
<tr>
<td>Other</td>
<td>8.5%</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
</tr>
<tr>
<td>Married/Common law</td>
<td>34%</td>
</tr>
<tr>
<td>Divorced/Separated</td>
<td>8.5%</td>
</tr>
<tr>
<td>Never married/single</td>
<td>57.4%</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;$29,999</td>
<td>12.8%</td>
</tr>
<tr>
<td>$30,000-$69,999</td>
<td>40.4%</td>
</tr>
<tr>
<td>$70,000-$99,999</td>
<td>21.3%</td>
</tr>
<tr>
<td>&gt;$100,000</td>
<td>25.5%</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
</tr>
<tr>
<td>Full-time employment</td>
<td>61.7%</td>
</tr>
<tr>
<td>Part-time employment</td>
<td>17.0%</td>
</tr>
<tr>
<td>Unemployed</td>
<td>10.6%</td>
</tr>
<tr>
<td>Student</td>
<td>2.1%</td>
</tr>
<tr>
<td><strong>2 previous episodes of MDD</strong></td>
<td>31%</td>
</tr>
<tr>
<td><strong>≥3 previous episodes of MDD</strong></td>
<td>59%</td>
</tr>
<tr>
<td><strong>Age of first depressive episode</strong></td>
<td>20.24(9.5)</td>
</tr>
<tr>
<td><strong>Age of first contact with mental health services</strong></td>
<td>25.78(9.5)</td>
</tr>
<tr>
<td><strong>Past Hospitalization</strong></td>
<td>23.4%</td>
</tr>
<tr>
<td><strong>Suicide Attempts</strong></td>
<td>12.8%</td>
</tr>
<tr>
<td><strong>Family History of mental illness</strong></td>
<td>68.1%</td>
</tr>
<tr>
<td><strong>Previous or current psychotherapy</strong></td>
<td>91.5%</td>
</tr>
<tr>
<td><strong>Currently taking pharmacotherapy</strong></td>
<td>63.8%</td>
</tr>
</tbody>
</table>

N = 47
Table 2
Participant Inclusion Chart

Face-to-Face Screening
\( n = 213 \)

Excluded, \( n = 55 \)

Consented & randomly allocated:
\( n = 158 \)

CBT
\( n = 78 \)

Invited to ESM
\( n = 33 \)

Consented ESM
\( n = 25 \)

ESM (>30%)
\( n = 23 \)

Remission
\( n = 18 \)

Residual
\( n = 5 \)

Relapse
\( n = 0 \)

MBCT
\( n = 80 \)

Invited to ESM
\( n = 35 \)

Consented ESM
\( n = 24 \)

ESM (>30%)
\( n = 19 \)

Remission
\( n = 17 \)

Residual
\( n = 1 \)

Relapse
\( n = 1 \)

\( n = 1 \) did not start ESM
- All data lost
Lost weeks:
- \( n = 5 \) due to equipment failure
- \( n = 4 \) low response rate
- \( n = 2 \) lost contact

\( n = 1 \) did not start ESM
- Traveling
Lost weeks:
- \( n = 11 \) due to equipment failure
- \( n = 5 \) low response rate
- \( n = 4 \) lost contact
Table 3

*Experience Sampling Probes*

### Two randomly selected positive question from the PANAS
- How INTERESTED are you feeling right now? Not at all (1) - Extremely (10)
- How EXCITED are you feeling right now? Not at all (1) - Extremely (10)
- How STRONG are you feeling right now? Not at all (1) - Extremely (10)
- How ENTHUSIASTIC are you feeling right now? Not at all (1) - Extremely (10)
- How PROUD are you feeling right now? Not at all (1) - Extremely (10)
- How ALERT are you feeling right now? Not at all (1) - Extremely (10)
- How INSPIRED are you feeling right now? Not at all (1) - Extremely (10)
- How DETERMINED are you feeling right now? Not at all (1) - Extremely (10)
- How ATTENTIVE are you feeling right now? Not at all (1) - Extremely (10)
- How PROUD are you feeling right now? Not at all (1) - Extremely (10)

### Two randomly selected negative question from the PANAS
- How DISTRESSED are you feeling right now? Not at all (1) - Extremely (10)
- How UPSET are you feeling right now? Not at all (1) - Extremely (10)
- How GUILTY are you feeling right now? Not at all (1) - Extremely (10)
- How SCARED are you feeling right now? Not at all (1) - Extremely (10)
- How HOSTILE are you feeling right now? Not at all (1) - Extremely (10)
- How IRRITABLE are you feeling right now? Not at all (1) - Extremely (10)
- How ASHAMED are you feeling right now? Not at all (1) - Extremely (10)
- How NERVOUS are you feeling right now? Not at all (1) - Extremely (10)
- How JITTERY are you feeling right now? Not at all (1) - Extremely (10)
- How AFRAID are you feeling right now? Not at all (1) - Extremely (10)

### One randomly selected dysphoric self question
- I feel like a failure. Disagree (1) - Agree (10)
- I feel like a loser. Disagree (1) - Agree (10)
- I feel inferior. Disagree (1) - Agree (10)

### One randomly selected dysphoric social question
- I feel rejected. Disagree (1) - Agree (10)
- I feel disrespected. Disagree (1) - Agree (10)
- I feel disliked. Disagree (1) - Agree (10)

### One stress aggregation question
- Are you facing a difficulty right now? No difficulty (1) - Extremely difficult (10)
Table 4
*CBT and MBCT Homework Skills*

<table>
<thead>
<tr>
<th>Homework Skill</th>
<th>CBT</th>
<th>MBCT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formal</strong></td>
<td>Weekly Activity Scheduling</td>
<td>Sitting Meditations</td>
</tr>
<tr>
<td></td>
<td>Goal Setting</td>
<td>Body Scans</td>
</tr>
<tr>
<td></td>
<td>Thought Records</td>
<td>Yoga</td>
</tr>
<tr>
<td></td>
<td>Cognitive Restructuring</td>
<td>Mindful Walking</td>
</tr>
<tr>
<td><strong>Informal</strong></td>
<td>Assertiveness</td>
<td>3 Minute Breathing Space</td>
</tr>
<tr>
<td></td>
<td>Anxiety Reduction</td>
<td>Everyday Mindfulness</td>
</tr>
</tbody>
</table>
Table 5
Means, standard deviations, and bivariate correlations

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Positive Affect</td>
<td>1</td>
<td>-.33**</td>
<td>-.35**</td>
<td>-.33**</td>
<td>-.09*</td>
<td>-.06</td>
<td>-.01</td>
<td>.26*</td>
<td>-.13*</td>
<td>56.57</td>
<td>20.82</td>
</tr>
<tr>
<td>2. Negative Affect</td>
<td>1</td>
<td>.67**</td>
<td>.66**</td>
<td>.02</td>
<td>.06</td>
<td>-.03</td>
<td>-.19*</td>
<td>.53**</td>
<td>21.75</td>
<td>21.00</td>
<td></td>
</tr>
<tr>
<td>3. Dysfunctional Thinking</td>
<td>1</td>
<td>.51**</td>
<td>.03</td>
<td>.05</td>
<td>-.09*</td>
<td>-.29*</td>
<td>.37**</td>
<td>18.87</td>
<td>21.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Stress</td>
<td>1</td>
<td>.08*</td>
<td>.11*</td>
<td>-.07</td>
<td>-.20</td>
<td>.22**</td>
<td>30.64</td>
<td>26.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Formal Homework (F)</td>
<td>1</td>
<td>.77**</td>
<td>.47**</td>
<td>.10**</td>
<td>-.02</td>
<td>1.05</td>
<td>.76</td>
<td></td>
<td></td>
<td></td>
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<td>6. Formal Homework (T)</td>
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<td>.16**</td>
<td>.26**</td>
<td>.09*</td>
<td>23.83</td>
<td>19.66</td>
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<td>-.20**</td>
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<td>.93</td>
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<td>8. Informal Homework (T)</td>
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<td>4.06</td>
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<td>9. QIDS</td>
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<td>3.95</td>
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Note. N = 42. Descriptive statistics were calculated by averaging each variable within each participant. (T) represents the time in minutes per day of practice, and (F) represents the frequency per day. * p < .05, ** p < .01, *** p < .001
Table 6  
Beta coefficients (and Standard Error Betas) of Stress and Mood States in Remitted Depressed Patients

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>R²</th>
<th>95% C.I.</th>
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<td>.15</td>
<td></td>
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<td>.03</td>
<td>4.72</td>
<td>&lt;.001*</td>
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<td>[.08, .21]</td>
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<td>.04</td>
<td>-.05</td>
<td>.97</td>
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<td>[-.07, .07]</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
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<td>.06</td>
<td>-2.68</td>
<td>.007*</td>
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<td>[-.29, -.05]</td>
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<td>-2.32</td>
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<td>.05</td>
<td>-3.49</td>
<td>.001*</td>
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<td>.74</td>
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<td>.0012</td>
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<td>.013*</td>
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<td>.43</td>
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<td>.123</td>
<td>.90</td>
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<td>6.66</td>
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<td>.02*</td>
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<td>[.03, .37]</td>
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<td>-.81</td>
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<td>.0009</td>
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<td>.01*</td>
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<td>.03</td>
<td>.65</td>
<td>.51</td>
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<td>[-.03, .066]</td>
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Note. N=42. All homework is reported in frequency per day.
*Figure 1.* The impact of stress and dysfunctional thinking on positive affect. This figure depicts the interaction between stress and dysfunctional thinking on positive affect.
Figure 2. The effect of dysfunctional thinking and stress on NA. This figure depicts the interaction between dysfunctional thinking and stress as they relate to negative affect.
Figure 3. The effect of stress and formal homework practice (frequency per day) on negative affect. This figure depicts the interaction between stress and the frequency of formal homework practice on NA.
Figure 4. NA and symptom severity. This figure depicts the relationship between NA and depressive symptoms measured via the QIDS-SR.