Salutary Proximal Processes and Distal Mood and Anxiety Vulnerability Outcomes of Mindfulness Training: A Pilot Preventive Intervention

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The present study evaluated the effect of a brief mindfulness-based preventive intervention on (a) dispositional (MAAS; Brown & Ryan, 2003) and state (SMS; Tanay & Bernstein, 2010) mindfulness; (b) putative proximal factors/processes engendered through the development of mindfulness, including increased decentering (EQ-D; Fresco et al., 2007) and reduced experiential avoidance (AAQ; Hayes et al., 2004); and (c) distal mood and anxiety vulnerability factors, including reduced depression-related dysfunctional attitudes, (DAS; de Graaf, Roelofs, & Huibers, 2009), anxiety sensitivity (ASI-3; Taylor et al., 2007), and negative affectivity (PANAS-NA; Watson, Clark, & Tellegen, 1988) among a university–community sample in Israel. Fifty-three adult participants between the ages of 20 and 52 (M<sub>age</sub> = 25.2 years, SD<sub>age</sub> = 4.3 years; 65.4% women) were recruited from the Haifa University community. Nineteen participants were randomly assigned to an experimental condition and studied prospectively over the course of a four-session (21-day) mindfulness skills training intervention; and 34 participants were randomly assigned to a no-intervention (control) condition (M<sub>age</sub> = 24.9 years, SD<sub>age</sub> = 2.4 years; 64.7% women) and studied prospectively. Findings demonstrate statistically robust and clinically significant relations between mindfulness and the theorized proximal and distal mood and anxiety vulnerability factors. Findings are discussed with respect to their theoretical implications for better understanding mindfulness-psychopathology vulnerability relations, clinical implications for larger-scale universal and selective transdiagnostic prevention efforts, and future directions for this area of research.

Keywords: mindfulness; mechanism; anxiety; transdiagnostic; prevention

Mindfulness research is a rapidly developing domain of scholarship within contemporary clinical psychology, psychological science more broadly, and related disciplines (Brown, Ryan, & Creswell, 2007; Didonna, 2009). Brown and colleagues conceptualized mindfulness as a quality of consciousness characterized by clarity of attention, flexibility of attention, and nondiscriminatory awareness (see also Brown & Ryan, 2003). This conceptual definition is grounded in and consistent with Buddhist perspectives of mindfulness (Sayadaw U Pandita, 2002). Many mindfulness-based interventions are intended to promote mindfulness in order to reduce vulnerability for, maintenance of, and relapse to various forms of psychopathology.
Mindfulness and Putative Proximal Processes

At least two proximal factors/processes may be engendered by the development of mindfulness and thereby putatively underlie, or mediate, the effect(s) of mindfulness on reduced distal mood and anxiety psychopathology vulnerability (Orsillo, Roemer, & Holowka, 2005). The first factor/process, experiential avoidance (EA; related constructs/processes may include coping, acceptance, distress tolerance; Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Zvolensky, Bernstein, & Vujanovic, in press), has been proposed by Hayes and others to contribute to the development and maintenance of many forms of psychopathology (Hayes et al., 2006; Kashdan, Barrios, Forsyth, & Steger, 2006). Indeed, mindfulness practice may directly and proximally reduce EA by facilitating a new set of nonavoidant behavioral responses (Arch & Craske, 2006; Roemer & Orsillo, 2002). However, the role of experiential avoidance as a proximal process engendered by mindfulness, and a potential mechanism linking mindfulness to reduced mood and anxiety vulnerability and psychopathology, has received only limited empirical study to date (Kumar, Feldman, & Hayes, 2008; Mitmansgruber, Beck, Höfer, & Schüßler, 2009).

The second proposed proximal factor/process putatively engendered by mindfulness is decentering (related constructs/processes may include cognitive defusion, reperceiving, and metacognitive awareness; Hayes, Strosahl, & Wilson, 1999; Hayes & Wilson, 2003; Shapiro et al., 2006; Teasdale et al., 2002). Decentring is "the ability to observe one's thoughts and feelings as temporary, objective events in the mind, as opposed to reflections of the self that are necessarily true" (Safran & Segal, 1990). Conceptually, decentering may be proximally engendered by mindfulness practice, as well as key to subsequent reductions in distal mood and anxiety vulnerability factors and symptoms (Carmody, Baer, Lykens, & Olendzki, 2009; Hayes et al., 2006; Shapiro et al., 2006). Initial findings support the idea that mindfulness leads to greater capacity for reperceiving, a process closely related to decentering (Carmody et al., 2009; Farb et al., 2007). Even brief experimental mindfulness inductions have been linked to increased levels of decentering (Erisman & Roemer, 2010; Feldman, Greeson, & Senville, 2010).

Mindfulness and Distal Mood and Anxiety Vulnerability Factors

In addition to a better understanding of proximal processes engendered by mindfulness it is also important to test the effect of mindfulness, and the proximal processes it may engender, on more distal vulnerability factors underlying the development and maintenance of mood and anxiety psychopathology (Orsillo & Roemer, 2005; Teasdale et al., 2002; Zvolensky et al., 2005).

First, one important factor that has been linked to vulnerability and maintenance of depression is depressive dysfunctional attitudes—depressive cognitive distortions involving negative and inflexible assumptions and beliefs related to self (Beck, 2008; Ingram, Miranda, & Segal, 1998; Meyer et al., 2003). Insofar as development of mindfulness may lead to reduced experiential avoidance and increased decentering, the degree to which a person may strongly hold extreme and inflexible dysfunctional attitudes about him- or herself may be reduced over time (Ramel, Goldin, Carmona, & McQuaid, 2004). Despite data demonstrating that the development of mindfulness is related to reduced risk of future relapse of depressive episodes in previously depressed patients (e.g., Ma &
Ingram, & Segal, 2005; Teasdale et al., 2002). Anxiety-related sensations (Reiss & McNally, 1985; Zvolensky et al., 2005) and linked to the development and maintenance of panic and other forms of anxiety psychopathology symptoms and disorders (Olatunji & Woltzky-Taylor, 2009). Insofar as the development of mindfulness may lead to reduced experiential avoidance and increased decentering, nonreactive present-moment attention and awareness involving nonavoidant experience of anxiety and related sensations may result in increasingly reduced fear of anxiety and anxiety-eliciting contexts over time (e.g., via exposure, habituation, and related learning; Bernstein et al., 2011). Though theoretically promising, only limited cross-sectional empirical study has to date focused on the putative relations between mindfulness and anxiety sensitivity (McKee, Zvolensky, Solomon, Bernstein, & Leen-Feldner, 2007; Vujanovic, Zvolensky, Bernstein Feldner, & McLeish, 2007).

Third, in addition to factors that may be specifically related to vulnerability or maintenance for depression or anxiety disorders, other factors have been linked to shared or transdiagnostic vulnerability for depression and anxiety psychopathology (e.g., Harvey, Watkins, Mansell, & Shafran, 2004; Kring & Sloan, 2010; Watson & Clark, 1984). Negative affectivity—the predisposition to experience negatively valenced emotional states (Watson, Clark, & Tellegen, 1988)—is related to mood and anxiety disorders (e.g., Brown, Chorripita, & Barlow, 1998). Extant research has indeed documented relations between mindfulness and reduced negative affectivity (Brown & Ryan, 2003; Davidson et al., 2003; Shapiro, Brown, & Biegel, 2007; Zvolensky, Solomon, et al., 2006).

GAPS IN KNOWLEDGE: MINDFULNESS, PROXIMAL MECHANISMS, AND MOOD AND ANXIETY VULNERABILITY

The present study is thus intended to address four primary gaps in extant mindfulness research. First, only limited research has prospectively evaluated factors/processes that may be proximally engendered by the development of mindfulness via mindfulness practice including experiential avoid-

ance and increased decentering. Second, there is only limited empirical knowledge of the effect(s) of the development of mindfulness on more distal cognitive-affective vulnerability factors for mood and anxiety disorders, such as depressive dysfunctional attitudes, anxiety sensitivity, and negative affectivity. Third, extant research has not yet evaluated whether the putative proximal outcomes of mindfulness practice (experiential avoidance, decentering) may underlie the relations between mindfulness and reductions in more distal depression and anxiety vulnerability factor outcomes. Such knowledge, however, is foundational to understanding why and how it is that development of mindfulness may be linked to reduced mood and anxiety psychopathology vulnerability. Finally, we lack preventive intervention study of the effect of mindfulness on these proximal processes and distal vulnerability factors specifically among community-based nonclinical samples (Baer, 2007). In contrast to extant mindfulness-based treatment research conducted among clinical samples, preventive intervention research targeting nonclinical community-based samples is important to advancing risk-factor research broadly and explicating vulnerability and resilience engendered by mindfulness specifically (Kraemer, Kazdin, Offord, & Kessler, 1997; Zvolensky, Schmidt, Bernstein, & Keough, 2006).

PRESENT STUDY AIMS AND HYPOTHESES

The present study involved a preliminary prospective evaluation of a brief mindfulness-based preventive intervention among a university-community sample. Participants were assigned randomly to a control (no-intervention) condition or an experimental (four-session 21-day mindfulness skills training intervention) condition and evaluated prospectively from pre- to postintervention. First, we hypothesized that mindful attention and awareness is malleable, and therefore we expected to observe change (elevation) in the construct over the course of a brief mindfulness skills training preventive intervention. Second, we

1 This gap in knowledge and research may be partially attributed to the fact that many conceptual definitions and related measures of mindfulness include aspects of experiential avoidance, decentering, and related constructs within them (Five Facets of Mindfulness Questionnaire; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Toronto Mindfulness Scale; Lau et al., 2006). Indeed, much contemporary mindfulness scholarship has not conceptualized these putative proximal processes as causal sequelae of mindfulness development, but rather has incorporated them as elements of mindfulness itself (Baer et al., 2006; Linehan, 1993). Buddhist formulations of mindfulness, however, make this distinction between mindfulness and its proximal outcomes (Kuan, 2008).
predicted that relative to participants assigned to the control condition, those assigned to the experimental condition would demonstrate greater prospective change (reduction) in experiential avoidance and decentering—the proximal factors/processes putatively engendered through the development of mindfulness; as well as greater reductions in distal mood and anxiety vulnerability factors. Furthermore, within the experimental condition, development of mindfulness over the course of the preventive intervention would be significantly prospectively related to reduced levels of experiential avoidance and increased decentering, as well as to reduced levels of distal mood and anxiety vulnerability factors. Finally, we predicted that within the experimental condition, increased decentering and reduced experiential avoidance would be significantly prospectively related to reduced levels of mood and anxiety vulnerability factors. The conceptual rationale for the latter hypothesis, though not tested formally within the present study, is that the proposed putative proximal processes may mediate the conceptually more distal association between mindfulness and reduced mood and anxiety vulnerability outcomes (Baer, 2007; Carmody et al., 2009; Orzech et al., 2009; Shapiro et al., 2006). Mediation was not, however, tested in the present study due to insufficient statistical power to do so (limited sample size; Fritz & MacKinnon, 2007).

Method

Participants

Fifty-three adult participants between ages 20–52 ($M_{age} = 25.2$ years, $SD_{age} = 4.3$ years; 65.4% women) were recruited from the Haifa University community through university–community ads posted on public boards and through Web-based ads. A total of 99 individuals initially responded to the ads. Forty-six of these individuals were either excluded from participation (based on exclusion criteria, described below) or chose not to participate for the following reasons: previous mindfulness meditation experience ($n = 19$), weekly yoga practice ($n = 5$), chronic illnesses ($n = 6$), or a stated lack of interest in participating ($n = 16$). Of the eligible and interested 53 participants, 19 participants were randomly assigned to the experimental (mindfulness skills training) condition ($M_{age} = 25.3$, $SD_{age} = 4.3$; 66% women) and 34 to the control (no-intervention) condition ($M_{age} = 24.9$ years, $SD_{age} = 2.4$ years; 64.7% women). Ninety-five percent of the participants were Jewish and 5% were either Christian or Muslim. Of the 19 participants assigned to the experimental condition, 17 were
successfully retained and completed postintervention assessment—specifically, 14 participants attended all four mindfulness training sessions and 3 participants attended three of the four sessions; in addition, 1 participant attended only one session and 1 participant did not attend any session, though neither completed postintervention assessment. Of the 34 who enrolled in the control condition, all 34 were prospectively retained and completed the pre- and postintervention assessments. See Figure 1 for CONSORT diagram.

To ensure the study's internal validity, participants were excluded from participation based on evidence of (a) current participation in regular yoga practice (weekly); or a weekly yoga class/workshop; (b) past/current participation in a meditation practice or meditation class/workshop; (c) current chronic illness (e.g., epilepsy, cancer); (d) lack of Hebrew-language fluency; or (e) inability to give informed, written consent. The study received human subjects research ethics approval by a University of Haifa IRB committee.

MEASURES
Translation and Back-Translation Process
As in other studies conducted within our laboratory, measures were translated from English to Hebrew by laboratory staff, fluent in Hebrew and English. The scales were then back translated by a separate party using structured guidelines (Geisinger, 1994). The accuracy of the translated measure was then evaluated; no major discrepancies were detected in the back-translation procedure. However, through the back-translation procedure, wording of certain questions was adjusted in minor ways to enhance their readability in Hebrew. This is a recommended approach for translation, and it has been used extensively in past work (Brislin, 1970; Kotov, Schmidt, Zvolensky, Vinogradov, & Antipova, 2005; Zvolensky et al., 2007).

Descriptive and Eligibility Baseline Measures
Participants provided demographic and related personal background information by means of an interview, when determining participant eligibility by telephone.

Mindful Attention Awareness Scale
The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item questionnaire in which respondents indicate, on a 6-point Likert-type scale (1 = almost always to 6 = almost never), their level of dispositional awareness and attention to present events and experiences (Brown & Ryan, 2003). Sample MAAS items include “I rush through activities without being really attentive to them” and “I find it difficult to stay focused on what’s happening in the present.” The MAAS has demonstrated good internal consistency across a range of samples (α = .80–.87; Brown & Ryan, 2003), and strong test–retest reliability data over a 1-month time period (r = .81; Brown & Ryan, 2003).

State Mindful Scale
The State Mindful Scale (SMS; Tanay & Bernstein, 2010) is a 25-item questionnaire in which respondents indicate on a 5-point Likert-type scale (1 = not at all to 5 = very well) their perceived level of awareness and attention to their present experience during a specific period of time (i.e., past 15 minutes) and context (e.g., following mindfulness meditation or other activity). The SMS is a novel measure of state-level present moment-to-moment mindfulness, recently developed to index mindfulness as conceptualized within Buddhist and some contemporary cognitive-behavioral scholarship. Specifically, items were developed based on Buddhist formulation of the four foundations of mindfulness from the Satipatthana Sutta, a canonical Buddhist text on meditation and the development of mindfulness. The four foundations include mindfulness of the body (Kāyā), sensations/feelings (Vedanā), consciousness (Cittā), and mental objects (Dhammā). Items were developed to represent each of the first three foundations (body sample item: “I clearly physically felt what was going on in my body,” sensations/feelings sample item: “I tried to pay attention to pleasant and unpleasant sensations,” consciousness sample item: “I noticed pleasant and unpleasant emotions”). Items were not generated to represent the fourth foundation—related to the more complex Buddhist concept of mental objects, which is of greater relevance to later, more advanced stages of the development of mindfulness (Nyanaponika, 1965). In addition, detailed descriptions of mindfulness were taken from canonical texts (e.g., Abhidhamma) and contemporary writings (Bodhi, 2000, Kabat-Zinn, 1990), through which five qualities of mindfulness were derived for the purpose of explicating state mindfulness, including awareness, sensitivity, deliberate attention to the present moment, intimacy or closeness to one’s subjective experience, and curiosity. Item development was thus guided by the core Buddhist foundations and qualities of mindfulness (awareness sample item: “I felt aware of what was happening inside of me,” sensitivity sample item: “I perceived many small details of my experience,” deliberate attention to the present sample item: “I actively explored my experience in the moment,” intimacy sample item: “I felt closely connected to the present moment,” and curiosity sample item: “I
found some of my experiences interesting”). Thus, all derived SMS items reflect one or more of the three noted foundations and one or more of the five qualities of mindfulness. The SMS will serve as the secondary measure of mindfulness in the present investigation. The present study is one element of a larger, ongoing psychometric investigation of the SMS in our laboratory. In the present study the SMS demonstrated strong internal consistency (α=.92) and strong 1-week test–retest reliability measured immediately following weekly mindfulness meditation sessions (r=.72); in other preliminary data, the SMS has demonstrated strong convergent and discriminant validity with respect to multiple measures of mindfulness and related processes (Tanay & Bernstein, 2010).

Acceptance and Action Questionnaire
The Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004) is a nine-item questionnaire, in which respondents indicate on a 7-point Likert-type scale (1=never true to 7=always true), their levels of emotional avoidance and emotion-focused inaction, conceptualized as experiential avoidance. Sample items include “When I am feeling depressed or anxious, I am unable to take care of my responsibilities” and “I rarely worry about getting my anxieties, worries, and feelings under control” (reverse scored). Low scores correspond to high experiential avoidance, or the unwillingness to remain in contact with unwanted feelings and thoughts, whereas high scores reflect acceptance and action. The AAQ has been found to have adequate internal consistency (α=.70). In the present study, the AAQ demonstrated adequate internal consistency among the total sample (α=.81). Strong 1-week test–retest reliability measured immediately following weekly mindfulness meditation sessions (r=.72); in other preliminary data, the AAQ has demonstrated strong and improved reliability and factorial validity relative to previous measures of the construct, as well as convergent, discriminant, and criterion-related (known-group) validity (Taylor et al., 2007).

Experiences Questionnaire–Decentering Subscale
The Experiences Questionnaire (EQ; Fresco et al., 2007) is a 20-item self-report scale, in which participants rate items on a 7-point Likert-type scale (1=never to 7=all the time), assessing decentering and rumination. The Decentering subscale targets the capacity to take a metacognitively detached or observant perspective of one’s thoughts and emotions. Sample items include “I can separate myself from my thoughts and feelings” and “I view things from a wider perspective.” High scores reflect elevated decentering and low scores reflect low levels of decentering. In the present sample, the EQ-D demonstrated adequate internal consistency among the total sample (α=.74) and a robust 3-week test–retest reliability among controls (r=.76, p<.01). 2

Anxiety Sensitivity Index–3
The Anxiety Sensitivity Index–3 (ASI-3; Taylor et al., 2007) is an 18-item scale that has demonstrated the strongest psychometric properties of measures of AS to date (Taylor et al., 2007). The ASI-3 is composed of three subscales: Physical Concerns, Cognitive Concerns, and Social Concerns, and one total scale score comprised of these subscales. ASI-3 items are rated on a 5-point Likert-type scale (0=very little to 4=very much). Sample items include “It scares me when my heart beats rapidly” and “I worry that other people will notice my anxiety.” Higher scores reflect greater levels of sensitivity. The ASI-3 and its subscales demonstrated strong and improved reliability and factorial validity relative to previous measures of the construct, as well as convergent, discriminant, and criterion-related (known-group) validity (Taylor et al., 2007).

Dysfunctional Attitudes Scale–Revised
The Dysfunctional Attitudes Scale–Revised (DAS-17; de Graaf, Roelofs, & Huibers, 2009) is a 17-item version of the DAS-A, a self-report measure of depression-related dysfunctional attitudes. Participants rate the depression-related dysfunctional attitudes that they generally hold using a 7-point Likert-type scale (1=fully disagree to 7=fully agree). Sample items include “If I fail partly, it is as bad as a complete failure” and “If other people know what you’re really like, they will think less of you.” Higher scores reflect more depression-related dysfunctional attitudes. The DAS-17 has demonstrated high levels of internal consistency (α=.91) and good discriminant validity in differentiating between depressed and nondepressed subjects (de Graaf et al., 2009).

Positive and Negative Affect Schedule
The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) is a 20-item self-

2 A second measure of decentering and related processes was used in this study—the Cognitive Fusion Questionnaire (CFQ; Dempster, Bolderston, Gillanders, & Bond, 2009). The CFQ demonstrated adequate internal consistency (α=.86) and strong test–retest reliability (r=.83, p<.01) in the present study. Changes in MAAS scores from pre- to postintervention and change in SMS scores from pre- to post-Session 4 were significantly correlated with change in cognitive fusion (r=.84, p<.01; r=.70, p<.01, respectively). Change in CFQ scores from pre- to postintervention was significantly correlated with change in DAS (r=.82, p<.01), ASI-3 (r=.69, p<.01), and PANAS-NA (r=.66, p<.01) scores.
report measure on which respondents indicate, on a 5-point Likert-type scale (1 = very slightly or not at all to 5 = extremely), the extent to which they generally feel different feelings and emotions (e.g., “hostile”). The PANAS is widely used in psychopathology research (Watson et al., 1988). In the proposed research, we evaluate only the PANAS-Negative Affectivity subscale, which has demonstrated strong convergent and discriminant validity, as well as high levels of internal consistency and test–retest reliability in numerous studies (Watson, 2000).

For all administered measures—with the exception of the SMS that referred to participants’ current state—the baseline instructions for each measure asked participants to rate how they generally feel, and postintervention instructions asked participants to rate how they felt in the past week.

PROCEDURE
Preintervention Baseline Assessment
All potential participants were screened by phone according to the exclusion criteria above. Participants meeting criteria were randomly assigned to either an experimental (mindfulness skills training) condition or a control (no-intervention) condition. Participants in both groups were asked to complete a consent form, after which they were asked to complete baseline (preintervention) measures administered through a widely used, password protected, and confidential online data collection system (Ahn, Flanagan, Marsh, & Sanislow, 2006; Finley, 1999). Specifically, each participant following screening was assigned a unique and confidential username and password through which he or she logged onto the study assessment Web site and completed the battery of measures described above.

Brief Mindfulness Skills Training Program
Following the baseline assessment, participants randomly assigned to the experimental condition participated in four weekly, 60-minute mindfulness skills training sessions; mindfulness training sessions were held exactly 7 days apart and carried out over 21 days. The first author (G.T.) led these mindfulness skills training sessions, using a manualized mindfulness intervention protocol developed by study authors based on established mindfulness meditation techniques in the Mahasi tradition (Nyanaponika, 1965; Sayadaw U Pandita, 2002). This practice is slightly different than the mindfulness meditation practiced in mindfulness-based stress reduction as it makes use of labeling and is briefer. The manual may be accessed in Hebrew or English by contacting the corresponding author (A.B.) at the International Research Collaborative on Anxiety laboratory at the University of Haifa.

The first mindfulness skills training session included a short introduction regarding mindfulness and the purpose of the mindfulness skills training program (i.e., to enhance participants’ ability to pay attention to their moment-to-moment subjective experience). Participants were explicitly not instructed that the purpose of the study was to reduce mood and anxiety vulnerability or to understand these outcomes with respect to mindfulness. Instead, participants were instructed that the purpose of the mindfulness training was simply to practice mindfulness. This instructional set was chosen in order to reduce experimental demand characteristics and permit a more conservative test of the proposed hypotheses.

Participants then engaged in a 20-minute guided practice of core mindfulness meditation techniques (i.e., mindful attention using the breath as an attentional anchor). Specifically, participants were asked to sit with closed eyes and guided to direct their attention to the physical sensations of their breath. Participants were guided to use these sensations as an attentional anchor in order to orient and maintain their attention on the present moment. Participants were further directed to pay attention to any other sensation(s), thought, or emotion as it occurs or appears, and to use an additional mindfulness technique, mental labeling of these events (i.e., brief, simple, descriptive process label of observed experience—“aching sensation,” “planning,” “worrying,” and “hearing”). Participants were encouraged to take a curious approach toward their experiences and the gradual process of acquiring mindfulness skills was emphasized. At the end of the 20-minute guided practice period, participants were invited to ask questions about the mindfulness skill and its practice for up to 15 minutes. Participants were then instructed to engage in an additional 10-minute guided practice of mindfulness meditation, as described above.

Furthermore, participants in the experimental condition were instructed to practice the mindfulness techniques at home (15 minutes, four times/week) between the mindfulness skills training sessions. An audio-CD of guided mindfulness practice instructions, specifically designed to rehearse and reinforce the in-session mindfulness skills training, was given to each participant at the end of Session 1. Sessions 2–4 included the same mindfulness techniques and practice content and format, but also included a short discussion of participants’ mindfulness skills practice at home since the previous session.
At the end of Session 4 (final session), participants completed a paper–pencil SMS. These data are used in the present study to evaluate levels of state mindfulness immediately following mindfulness meditation at the end of the preventive intervention. Furthermore, we collected mindfulness practice calendar data at the beginning of Session 2–4; specifically, participants were asked to report on the frequency and duration of their practice of mindfulness skills exercises on a daily basis, between sessions over the course of the 21-day intervention.

Postintervention Assessment
Participants in both the control and experimental conditions were asked to complete the battery of measures through the online data collection assessment system within 48 hours following the final mindfulness skills training session (Session 4). Participants in both experimental and control groups were individually contacted by the research team and reminded to complete the follow-up assessment.

Reimbursement Schedule
Participants in the experimental group who completed the baseline assessment, attended all sessions, and completed postintervention assessment received $30. Participants in the control group who completed baseline and postassessment received $20.

Results

AIM 1. BETWEEN- AND WITHIN-GROUP CHANGE IN MINDFULNESS

Table 1 presents descriptive statistics for pre- and postintervention levels of all studied variables. Relative to participants in the no-intervention control condition, participants in the experimental mindfulness condition demonstrated significantly greater improvement in MAAS scores from pre- to postintervention, \( t(49)=2.2, p<.05, \text{d}=.63 \). As another index of change in dispositional mindfulness, 41.2% participants demonstrated moderate or greater change in MAAS scores (pre–post change > 1 Reliable Change Index [RCI]) over the course of the intervention; in comparison, among the control group, only approximately 14.7% demonstrated such change. The number of participants demonstrating change on all studied variables, as indexed by the RCI (Jacobson & Truax, 1991), is presented in Table 2.

Relative to participants in the no-intervention control condition, participants in the experimental mindfulness condition demonstrated significantly greater improvement in SMS scores from pre- to postintervention, \( t(49)=2.4, p<.05, \text{d}=.68 \). As another index of change in state mindfulness, approximately 50.3% participants demonstrated moderate or greater change in SMS scores (pre–post change > 1 RCI) between preintervention and Session 4 (no data were collected at this time point in the control condition).
Table 2
Percent of Participants Demonstrating Change × Condition Based on the Reliable Change Index

<table>
<thead>
<tr>
<th></th>
<th>0&lt;RCI&lt;1</th>
<th>1&lt;RCI&lt;1.96</th>
<th>RCI&gt;1.96</th>
<th>RCI&lt;−1</th>
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<tr>
<td></td>
<td>Limited Improvement %</td>
<td>Improvement %</td>
<td>Large Improvement %</td>
<td>Deterioration %</td>
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<tr>
<td>Control</td>
<td></td>
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<td></td>
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<tr>
<td>Exp.</td>
<td>38.2%</td>
<td>29.4%</td>
<td>14.7%</td>
<td>23.6%</td>
</tr>
<tr>
<td>SMS</td>
<td>−</td>
<td>44.1%</td>
<td>−</td>
<td>37.8%</td>
</tr>
<tr>
<td>SMS</td>
<td>43.5%</td>
<td>35.4%</td>
<td>2.9%</td>
<td>17.9%</td>
</tr>
<tr>
<td>EQ-D</td>
<td>17.5%</td>
<td>35.3%</td>
<td>17.6%</td>
<td>17.7%</td>
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<tr>
<td>AAQ</td>
<td>26.4%</td>
<td>35.3%</td>
<td>29.4%</td>
<td>29.4%</td>
</tr>
<tr>
<td>ASI</td>
<td>48.5%</td>
<td>47.0%</td>
<td>18.2%</td>
<td>23.6%</td>
</tr>
<tr>
<td>DAS</td>
<td>38.3%</td>
<td>35.4%</td>
<td>8.8%</td>
<td>17.7%</td>
</tr>
<tr>
<td>PANAS-NA</td>
<td>24.9%</td>
<td>47.1%</td>
<td>14.2%</td>
<td>23.6%</td>
</tr>
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Note. RCI=Reliability Change Index; Control=control group (n=34); Exp. = experimental group (n=17); MAAS=Mindful Attention and Awareness Scale; SMS=State Mindfulness Scale; EQ-D=Experiences Questionnaire–Decentering subscale; AAQ=Acceptance and Action Questionnaire; ASI=Anxiety Sensitivity Index–3; DAS=Dysfunctional Attitudes Scale–17; PANAS–NA=Positive and Negative Affect Schedule—Negative Affectivity.

PRE- AND POSTINTERVENTION TESTS ON CHANGE IN STUDIED VARIABLES

Prior to evaluating the additional aims of the present study, we tested whether the participants in the experimental (mindfulness) group demonstrated significantly greater prospective change relative to the control group, in each of the studied outcome variables (see Tables 1 and 2). As predicted, relative to participants in the control group, participants in the experimental group demonstrated significantly greater reductions from pre- to postintervention in experiential avoidance, \(t(49)=2.1, p<.05, d=.60\); decentering, \(t(49)=2.0, p<.05, d=.57\); anxiety sensitivity, \(t(48)=2.1, p<.05, d=.61\); and negative affectivity, \(t(43)=2.2, p<.05, d=.67\).

No significant difference was observed between the conditions with respect to pre–post changes in dysfunctional attitudes, \(t(21.2)=1.2, ns\); however, within the mindfulness group, 23.6% demonstrated moderate or greater change (＞1 RCI) in dysfunctional attitudes. In light of change in dysfunctional attitudes observed within the mindfulness group (see Table 3), the planned within-group analyses evaluating change in dysfunctional attitudes as a criterion variable were conducted, as planned a priori, though interpreted cautiously.

AIM 2. RELATIONS BETWEEN CHANGE IN MINDFULNESS AND CHANGE IN PROXIMAL PROCESSES

Among participants in the experimental condition, change in MAAS scores from pre- to postintervention and change in SMS scores from pre-intervention to post-Session 4 were significantly correlated with change in decentering \((r=.72, p<.01; r=.68, p<.01,\) respectively) and experiential avoidance \((r=.87, p<.01; r=.66, p<.01,\) respectively).

AIM 3. RELATIONS BETWEEN CHANGE IN MINDFULNESS AND CHANGE IN DISTAL MOOD AND ANXIETY VULNERABILITY FACTORS

Consistent with predictions, elevations in MAAS scores from baseline to postintervention were negatively correlated with reductions in DAS \((r=-.77, p<.01)\), ASI-3 \((r=-.66, p<.01)\), and PANAS-NA \((r=-.49, p<.05)\) scores. As predicted, elevation in SMS scores from baseline to Session 4 were significantly correlated with reductions in DAS \((r=-.73, p<.01)\) and ASI-3 \((r=-.74, p<.01)\) but not PANAS-NA \((r=-.29, ns)\) scores.

AIM 4. RELATIONS BETWEEN CHANGE IN PROXIMAL PROCESSES AND CHANGE IN DISTAL MOOD AND ANXIETY VULNERABILITY FACTORS

Consistent with prediction, change in EQ-D scores from pre- to postintervention was significantly correlated with change in DAS \((r=-.68, p<.01)\), although observed moderate-sized correlation coefficients were nonsignificant with respect to change in ASI-3 \((r=-.39, p>.05)\) and PANAS-NA \((r=-.30, p>.05)\) scores. Consistent with prediction, change in AAQ scores from baseline to postintervention was significantly correlated with change in DAS \((r=-.88, p<.01)\), ASI-3 \((r=-.68, p<.01)\), and PANAS-NA \((r=-.67, p<.01)\) scores.

4 Nearly identical associations were observed between change in SMS from pre- to postintervention with respect to change in the criterion variables, as were reported for SMS from preintervention to post-Session 4.
Discussion

Though study of mindfulness and its clinical applications has advanced significantly in recent years, knowledge of the factors and processes that underlie the relations between mindfulness and psychopathology vulnerability remains relatively limited (Carmody et al., 2009; Coffey & Hartman, 2008; Shapiro et al., 2006; Teasdale et al., 2002). The purpose of the present study was thus to evaluate the effect of a brief randomized mindfulness-based preventive intervention on (a) dispositional and state mindfulness; (b) factors theorized to be proximally engendered through the development of mindfulness including decentering and experiential avoidance; and (c) putatively distal mood and anxiety vulnerability factors including dysfunctional attitudes, anxiety sensitivity, and negative affectivity.

First, we observed significant improvement in levels of dispositional and state mindfulness over the course of the four-session intervention, among participants assigned to the (experimental) mindfulness training condition. The size of the observed effects of mindfulness training on measures of mindfulness were similar to those reported in earlier mindfulness intervention studies (Nyklíček & Kuijpers, 2008). Second, development of dispositional and state mindfulness was strongly related to change in the putative proximal processes, specifically, reduced experiential avoidance and increased decentering. Third, development of dispositional and state mindfulness over the course of the intervention was related to reductions in depression-related dysfunctional attitudes and anxiety sensitivity. Partially consistent with predictions, though development of dispositional mindfulness was significantly related to reduced negative affectivity, development of state mindfulness was not. Finally, as expected, reduced levels of experiential avoidance, a putative proximal outcome of mindfulness, were related to reductions in the putatively distal

depression and anxiety vulnerability factors. Similarly, greater levels of decentering, also a putative proximal outcome of mindfulness, were related to reduced levels of depression-related dysfunctional attitudes. However, associations between greater levels of decentering and reduced levels of anxiety sensitivity and negative affect, though medium in size, were statistically nonsignificant. Therefore, the observed nonsignificant associations were likely a result of limited statistical power due to the small sample size within the experimental condition ($n=17$). Alternatively, it is also possible that elevated decentering as a function of mindfulness practice and the development of mindfulness is differentially related to specific salutary factors underlying mood and anxiety psychopathology, whereas EA may demonstrate a broader range of salutary relations. Consistent with theory and other emergent findings (Arch & Craske, 2006; Broderick, 2005; Carmody et al., 2009; Kumar et al., 2008; Teasdale et al., 2002), the present data help to explicate the potential salutary proximal processes engendered by means of mindfulness training and development, as well as begin to help explicate the potential transdiagnostic vulnerability and maintenance factors that may be therapeutically impacted by mindfulness and its salutary proximal sequelae.

The present preliminary study is limited in a number of respects relevant to future directions in this line of research. First, the study was conducted in Israel, among a university–community sample. Future research sampling a more diverse population or employing a multinational comparative design is important for evaluating the generalizability of the present findings. Second, the studied sample was small, limiting the reliability of the observed effects and statistical power, did not permit a sufficiently powered test of mediation (Fritz & MacKinnon, 2007), and limited our capacity to evaluate the

### Table 3

<table>
<thead>
<tr>
<th></th>
<th>SMS</th>
<th>MAAS</th>
<th>EQ-D</th>
<th>AAQ</th>
<th>ASI-3</th>
<th>DAS</th>
<th>PANAS-NA</th>
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</thead>
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<td>SMS</td>
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<td>.36*</td>
<td>.44**</td>
<td>.39*</td>
<td>-.42*</td>
<td>-.18</td>
<td>-.37*</td>
</tr>
<tr>
<td>MAAS</td>
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<td>.44**</td>
<td>.55**</td>
<td>-.38**</td>
<td>-.55*</td>
<td>-.60*</td>
</tr>
<tr>
<td>EQ-D</td>
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<td>.62*</td>
<td>.41*</td>
<td>.51*</td>
<td>.34</td>
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<tr>
<td>AAQ</td>
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<td></td>
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<tr>
<td>DAS</td>
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<td>PANAS-NA</td>
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</tbody>
</table>

* Note: SMS=State Mindfulness Scale; MAAS=Mindful Attention and Awareness Scale; EQ-D=Experiences Questionnaire–Decentering subscale; AAQ=Acceptance and Action Questionnaire; ASI=Anxiety Sensitivity Index–3; DAS=Dysfunctional Attitudes Scale–17; PANAS–NA=Positive and Negative Affect Schedule–Negative Affectivity. * = p<.05, ** p<.01.
possible role(s) of gender/sex on the present findings. Furthermore, the relatively small sample size also resulted in partial failure of randomization, resulting in significant, albeit relatively small, differences between the groups at baseline. Future work could thus evaluate a larger sample using blocked randomization techniques to ensure group equivalence at baseline.

Third, the present study does not provide data regarding the long-term stability of changes in mindfulness, or the effects of the mindfulness-based intervention and changes in mindfulness on mood and anxiety vulnerability factors over time or on the development of symptoms. Relatedly, factors/processes theorized to be proximal and distal were measured over a similar time period. Future work may usefully evaluate the long-term effects of the intervention on mindfulness and vulnerability, as well as match the timing of the measurement of putatively proximal and distal factors to their developmental and temporal conceptualization (i.e., measurement of putatively proximal processes temporally close to change in mindfulness and changes in putatively distal vulnerability factors and symptoms at later points in time). Such study may involve a universal prevention effort and/or selected preventive intervention targeting individuals at risk for mood and anxiety problems.

Fourth, the present study involved only a brief assessment and as such included only a selection of candidate distal mood and anxiety vulnerability outcomes. Other established vulnerability factors for mood and anxiety problems that may be affected by mindfulness and its proximal outcomes (e.g., rumination) were not assessed (Sher et al., 2005; Teasdale et al., 2002). Future research involving a more comprehensive assessment of such factors may be useful. Furthermore, the SMS is a novel measure and lacks published psychometric data. It was used in the present study due to the limited availability of psychometrically validated tools indexing the specific construct that the SMS was designed to measure; observed findings with respect to the SMS should, therefore, be interpreted cautiously.

Fifth, contact time with the experimenter, between the experimental and control conditions, was not controlled for in the present study. Future research could compare the mindfulness intervention to an active control. Finally, measurement methods were exclusively self-report in the present study. Evaluation of the effects of the mindfulness-based preventive intervention on multimethod experimental measures of the studied variables (e.g., behavioral experiential avoidance in response to lab-based emotion elicitation) may be a promising domain of future research (Erisman & Roemer, 2010; Zvolensky et al., 2005).

In summary, the present findings help explicate the candidate proximal and distal processes/factors related to the development of state and dispositional mindfulness. These findings have unique theoretical implications for illuminating mechanisms underlying the relations between mindfulness and mental health. Furthermore, clinically, the present study reflects one approach to transdiagnostic prevention in which protective and vulnerability factors underlying mood and anxiety psychopathology are mutually targeted through the development of mindfulness (Bernstein, 2010; Dozois, Seeds, & Collins, 2008).

References


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