Simultaneous Treatment of Neurocognitive and Psychiatric Symptoms in Veterans with Post-Traumatic Stress Disorder and History of Mild Traumatic Brain Injury: A Pilot Study of Mindfulness-Based Stress Reduction

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ABSTRACT
Treating patient populations with significant psychiatric and neurocognitive symptomatology can present a unique clinical dilemma: progress in psychotherapy can be significantly fettered by cognitive deficits, whereas neurocognitive rehabilitation efforts can be ineffective because of psychiatric overlay. Application of mindfulness-based interventions to address either cognitive or psychiatric symptoms in isolation appears efficacious in many contexts; however, it remains unclear whether this type of intervention might help address simultaneous neurocognitive and psychiatric symptomatology. In a pre-post mixed methods design pilot study, nine Veterans with post-traumatic stress disorder (PTSD) and a history of mild traumatic brain injury with chronic cognitive complaints participated in Mindfulness-Based Stress Reduction (MBSR). Clinical interview, questionnaires, and attention and PTSD measures were administered immediately before, immediately after, and 3 months after MBSR completion. Qualitative and quantitative findings suggest high levels of safety, feasibility, and acceptability. Measurement of attention revealed significant improvement immediately following MBSR ($p < 0.05$, $d = 0.57$) and largely sustained improvement 3 months after completion of MBSR ($p < 0.10$, $d = 0.48$). Significant reduction in PTSD symptoms was found immediately after MBSR ($p < 0.05$, $d = -1.56$), and was sustained 3 months following MBSR completion ($p < 0.05$, $d = -0.93$). These results warrant a randomized controlled trial follow-up. Potential mechanisms for the broad effects observed will be explored.

INTRODUCTION
Behavioral interventions in clinical populations with co-occurring psychiatric symptomatology and neurocognitive deficits can present unique treatment challenges. Specifically, efficacy of psychotherapy can be significantly reduced when cognitive deficits are present.1–3 For example, difficulties with attention can undermine an effective therapeutic process, whereas memory issues can reduce consolidation of therapeutic features of sessions as well as a patient’s ability to apply what has been learned to outside the session.4,5 Furthermore, cognitive rehabilitative treatment of patients with simultaneous psychiatric and cognitive symptoms can be rendered less effective because of significant psychiatric overlay or diagnosis.6–9 Though holistic or multimodal rehabilitative approaches that provide integrated treatment of cognitive and neuropsychiatric problems appear promising for individuals with moderate or severe traumatic brain injury (TBI),10 the efficacy for such programs in populations with...
chronic sequelae from mild traumatic brain injury (mTBI) or a comorbid psychiatric diagnosis remains unclear. Indeed, there have been multiple calls for research to address the problematic interaction of cognitive and psychiatric symptoms in behavioral treatments in addition to a call for the development of new treatment approaches in affected populations.11–13

These concerns are particularly pertinent to Veterans given the high prevalence of comorbid cognitive and psychiatric symptoms. In Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND), as many as 20% of returning service members report having suffered a TBI14 and the predominant TBI severity level sustained is mild.15 Postconcussive symptoms following a mTBI can include neuropsychiatric symptoms (e.g., depression, irritability) and neurocognitive symptoms (e.g., declines in attention, working memory). Though most studies in civilian mTBI suggest that the vast majority of individuals fully recover from the neuropsychiatric and neurocognitive symptoms,16 work by our group and others finds a much higher prevalence of chronic symptoms in returning OEF/OIF/OND soldiers with a history of mTBI.17 The increased chronicity observed in this and other Veteran cohorts is likely because of the differential context in which the mTBI is sustained (e.g., blast exposure), and subsequently, also an increased presence of comorbidities such as PTSD. Indeed, an overwhelming number of OEF/OIF/OND Veterans who return from combat having experienced a mTBI also endorse symptoms meeting criteria for PTSD.18,19 In a large sample of returning Veterans not necessarily seeking medical care, Hoge et al15 estimated that 44% of the soldiers, having sustained a TBI with loss of consciousness, met full diagnostic criteria for PTSD. Another study of OEF/OIF Veterans with a history of mTBI found that the presence of PTSD was associated with a marked increase in prevalence of three or more postconcussive symptoms.20 Other studies indicate that Veterans returning from Iraq and Afghanistan with a history of mTBI have a probable PTSD frequency of 33% to 39%.18,19,21,22 As many as 75% of the Veterans with a history of mTBI and current PTSD meet diagnostic criteria for postconcussive syndrome, highlighting the extent to which comorbid psychiatric and cognitive symptoms can be present.23 Presence of this type of comorbidity has been shown to generate a much greater risk for an adverse outcome.21

The recognition of the extent of co-occurrence of TBI and PTSD, and the associated clinical ramifications, is a relatively recent development in both fields of study. Consequently, there has been little work on efficacious treatment strategies for individuals with this comorbidity.24 A treatment that can target either cognitive or psychiatric symptoms with minimal susceptibility to interference from the other respective symptom type is highly desirable, and identification of a singular intervention that concurrently addresses both cognitive deficits and psychiatric symptomatology would be particularly advantageous. An emerging literature suggests that mindfulness-based interventions can improve cognitive functioning25 and decrease many forms of psychiatric symptoms,26 although these effects have not been examined within the same study.

Mindfulness training is operationally defined as involving two fundamental components: (1) intentional regulation of attention to, and awareness of, the present moment and (2) nonjudgmental acceptance of the ongoing stream of sensations, thoughts, and/or emotions experienced.27 Mindfulness-Based Stress Reduction (MBSR) is perhaps the most common approach currently applied in Western medicine. It is an 8-week structured behavioral medicine program originally developed by Jon Kabat-Zinn at the University of Massachusetts Medical School. Mindfulness training (e.g., sitting meditation, mindful yoga stretches) cultivates a shift away from worries of the past and concerns about the future to a present moment focus with a nonjudgmental stance toward experiences, thoughts and emotions that arise. A few recent studies suggest efficacy of mindfulness interventions in treating chronic TBI sequelae. An adapted MBSR class that included enhanced attentional training was effective in improving aspects of cognitive control, such as working memory and regulation of attention, while also improving quality of life and perceived self-efficacy.28 Another brief mindfulness intervention was also successful at improving attentional control deficits following TBI.29 Mindfulness-based cognitive therapy was found to improve depressive symptoms following TBI.30

Mindfulness-based approaches have generated particular interest as a way of reducing trauma-associated symptoms as well.31 When investigating dispositional mindfulness, several studies found that increases in facets of mindfulness traits are associated with lower levels of symptoms related to trauma exposure and PTSD.32–34 There is also preliminary direct evidence of PTSD symptom reduction by mindfulness intervention.35,36 In work highly relevant to the present study, Kearney et al37,38 provided support that MBSR in Veterans with PTSD is feasible and efficacious in reducing PTSD-associated symptoms. Other forms of mindfulness training (e.g., mindfulness-based cognitive therapy) and meditative practices (e.g., transcendental meditation) also show initial promise in reducing PTSD symptoms in active military service members and OEF/OIF Veterans.39–41

Given the evidence suggesting that mindfulness-based interventions can improve symptoms associated with chronic sequelae from TBI or symptoms associated with PTSD in isolation, we conducted a pilot study to explore the safety, acceptability, feasibility, and potential efficacy of MBSR on both neurocognitive and psychiatric measures in Veterans with a history of mTBI and comorbid PTSD.

METHODS

Participants

The Investigational Review Board for Veterans Affairs Northern California Health Care System (VA NCHCS) reviewed and approved this research. All participants provided formal
informed consent to participate in the approved research protocol. Inclusion criteria consisted of a self-reported history of mTBI and continued problems with cognitive symptoms. If present, loss of consciousness following a concussive event was 30 minutes or less, and post-traumatic amnesia was not more than 24 hours. Participants met inclusion criteria for PTSD via (1) a current PTSD diagnosis provided by the VA NCHCS Mental Health Clinic and (2) baseline PTSD Checklist- Civilian Version (PCL-C) responses meeting Diagnostic and Statistical Manual of Mental Disorders, Edition Four (DMS-IV) criteria for symptom clusters B, C, and D. Exclusion criteria included neurologic disease, learning disorder, current substance dependence or abuse diagnosis, Attention-Deficit/Hyperactivity Disorder, history of psychotic spectrum disorder, TBI sustained within 12 months of testing, and TBI in the moderate to severe range. Participants were also excluded if they were actively enrolled in PTSD treatment that involved exposure therapy, as this would be a potential contraindication for initiating participation in a mindfulness-based program because of the extensive time commitment and potential emotional burden of simultaneously participating in both interventions. Participants were referred to the Brain Health clinical research program at VA NCHCS from primary care, mental health, physical medicine, and neurology services. A total of 42 patients were assessed for eligibility, 26 were excluded because they did not meet inclusion criteria (21 did not have comorbid PTSD and mTBI history). Six were excluded as they met inclusion criteria but declined to participate because of lack of interest \((n = 1)\) or scheduling conflicts with course time offering \((n = 5)\). Ten participants were allocated to receive MBSR (single, uncontrolled arm) treatment, and nine completed the intervention. One participant discontinued after baseline testing but before the first MBSR introductory session because of a death in his family. The remaining nine participants completed the baseline assessment, MBSR, and immediate post-treatment assessment. One participant was lost to follow-up for the 3-month post-treatment follow-up because of the Veteran not responding to efforts to reach him. Table I provides descriptive characteristics of the participants.

<table>
<thead>
<tr>
<th>Table I. Descriptive Characteristics of Participants</th>
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<tbody>
<tr>
<td>Sample ((n = 9))</td>
</tr>
<tr>
<td>Age, Mean (SD)</td>
</tr>
<tr>
<td>Education, Mean (SD)</td>
</tr>
<tr>
<td>Race or Ethnicity, (n (%))</td>
</tr>
<tr>
<td>White, Non-Hispanic</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
</tr>
<tr>
<td>African American</td>
</tr>
<tr>
<td>TBI Characteristics</td>
</tr>
<tr>
<td>Total Number of mTBI, Mean (SD)</td>
</tr>
<tr>
<td>Number of mTBI with LOC, Mean (SD)</td>
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<tr>
<td>Number of mTBI with PTA, Mean (SD)</td>
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</table>

SD, standard deviation; mTBI, mild traumatic brain injury; LOC, loss of consciousness; PTA, post-traumatic amnesia.

**Procedures**

There were no fees for participants to enroll in the MBSR class and course materials were provided free of charge. Participants were not paid for time spent receiving assessments. If the participants’ level of annual income allowed for qualification for receiving VA travel reimbursement, they received reimbursement for travel for all assessment and intervention appointments. Participants received a postcard appointment reminder approximately 1 week before all appointments (assessment and MBSR classes).

**Intervention**

MBSR classes closely followed the structure originally developed at the University of Massachusetts Medical School. MBSR begins with a 2-hour introductory class. The course then entails meeting once per week for 2.5 hours each session for 8 weeks. A 7-hour session “day-long” retreat is conducted between week 6 and 7 classes. The retreat is conducted largely in silence and focuses on intensive practice of the mindfulness meditation techniques. Weekly class content consists of practice and receipt of instruction on mindfulness meditation, discussion of homework assignments, and an opportunity to ask questions and group discussion. Mindfulness techniques entail training in the ability to place sustained attention on an object of focus (e.g., breath) as well as open awareness to salient phenomenen in one’s body and environment. Participants were taught flexibility in the attentional focus so as to nonjudgmentally acknowledge thoughts and emotions that inevitably arise during the practice, and to simply return their attention back to the object of focus. Mindfulness training also emphasizes bringing kindness and an attitude that is curious to present-moment experience, including difficult and unpleasant experiences. The mindful meditation techniques taught and practiced include: (1) the “body scan” in which attention to sensations is systematically placed on each part of the body, (2) sitting meditation, (3) gentle yoga with mindfulness of movements and bodily sensations, (4) mindful eating, (5) mindful walking, and (6) loving-kindness meditation. In all of these mindfulness and meditative exercises, participants were instructed to maintain nonjudgmental awareness, accepting and “letting be” whatever arises during the practice. Because of the extent of orthopedic injuries sometimes present in this population, the participants were introduced to a greater range of lower impact gentle yoga techniques that included more standing and chair exercises. Also, participants were frequently instructed to take particular care to not overexert during gentle yoga exercises and to consider taking a break or substituting another exercise during gentle yoga exercises if there was any concern about an area of injury. Participants were provided with homework assignments each week, which consisted of daily meditation or yoga for 45 minutes per day, 6 days per week, using CDs as guidance. In addition, homework included assignments of bringing mindfulness to different types of daily life experiences each week. Classes...
Assessment
A mixed-methods approach was used to provide a multilevel understanding and greater context to participants’ experience, in, and response to, MBSR. Assessments were performed within 2 weeks before the MBSR class, within 2 weeks following completion of the MBSR class, and 3 months after completion of the MBSR class. Clinical interview and cognitive and psychodiagnostic assessments were performed by licensed and VA credentialed clinical psychologists. To assess safety, acceptability and feasibility, information was systematically collected on class attendance, home practice logs, and adverse events. Minimum participation compliance criteria was set at attendance of seven of ten classes (introductory class, eight class sessions, and full-day retreat) and an average of at least 2 hours of home practice each week. Participant rating of the MBSR course was also collected anonymously at the end of the class. Participants were also interviewed and provided responses to a questionnaire that asked about their experiences in the class.

PTSD symptoms were measured with the PTSD Checklist-Civilian version (which includes symptoms related to military and civilian traumas). In this 17-item questionnaire that assesses Criteria B, C, and D for PTSD (DSM-IV), participants rated how much they were bothered by each symptom on a 5-point scale ranging from 1 (not at all) to 5 (extremely). The Cronbach alpha of the PCL-C in a sample of Veterans seeking PTSD treatment is 0.97. The Cogstate computerized assessment system was utilized to measure attention (the Detection and Identification tasks). Cogstate was chosen because of its reliability, validity, and sensitivity to change in cognitive performance. The Detection task uses a well-validated simple reaction time paradigm. In this task, a stack of face-down playing cards (all red and black jokers) are in the center of the screen. The subject is asked to press the Yes key as soon as the card on the top of the stack of cards turns face up. The software measures the speed and accuracy of each response. These specific tests were selected because they are brief and can be given repeatedly without eliciting practice effects. The attention composite measure was computed by standardizing performance on each test relative to the baseline mean for the entire sample. The average of these two standardized scores was then calculated to generate the composite attention score.

Statistc Analyses
Paired t tests were conducted for each of the two primary efficacy outcomes (attention and PTSD) to evaluate change following the MBSR intervention (immediate and 3 months post-MBSR) as compared to baseline measurement. Standardized mean differences between baseline and post-MBSR intervention (Cohen’s d effect size) were calculated using the recommended formula for repeated measures by Morris and Deshon. Effect sizes are interpreted as follows: a small effect size is 0.20, a medium effect size is 0.50, and a large effect size is 0.80.

RESULTS
Safety
Safety was evaluated in part by determination of the presence of a one SD increase in self-reported symptoms on the PCL-C, which was not found in any of the participants. In addition, there were no adverse events reported or observed.

Acceptability
100% of the participants reported being “satisfied” with the MBSR class (Table II). Following the program, participants indicated improved ability to cope with stress and improved attitude toward their health following the program (Table II). Of note, none of the participants reported being worse or experiencing dissatisfaction in any of the areas of query. Additionally, all participants indicated having enjoyed the program. Participants also rated each primary component of the program (i.e., body scan, sitting meditation, yoga and gentle stretch, in-class guided meditation, and group discussions) for the extent to which they found it useful. There was an appreciable range of ratings for each component, but on average, each component was rated as being useful (Table II). Qualitative data consists of participant responses to the interview and a self-report questionnaire.

<table>
<thead>
<tr>
<th>TABLE II. Participant Rating of the MBSR Course</th>
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<tbody>
<tr>
<td>Question</td>
</tr>
<tr>
<td>Overall, How Do You Cope With Stress</td>
</tr>
<tr>
<td>Now Compared to Before the Stress Reduction Program?</td>
</tr>
<tr>
<td>Overall, How Is Your Attitude Now to Your Health Compared to Before the Stress Reduction Program?</td>
</tr>
<tr>
<td>How Satisfied Were You With This Program?</td>
</tr>
</tbody>
</table>

*Based on a Likert scale of 1 to 5: 1 = much worse than before; 5 = much better, great improvement. ^Based on a Likert scale of 1 to 5: 1 = not satisfied; 5 = extremely satisfied.
Participants rated each component of the class on a response scale that ranged from 1 (No use at all) to 10 (Very useful).

about changes experienced from the MBSR class, common participant themes included improved well-being, mindfulness skills, interpersonal skills, acceptance and awareness of medical and psychiatric conditions, such as thoughts related to previous traumas and physical pain, and decreased stress reactivity. Table IV provides the questions and exemplar responses. In regards to suggested improvements for the class, 3/9 participants suggested having shorter-duration classes with higher frequency (e.g., 1.5 hours two times per week).

Feasibility

None of the nine participants discontinued participation in the class. All participants were at or above the minimum participation compliance criteria for classes attended and weekly average for home practice. Mean class attendance was 8.3 out of 10 with a SD of 1.2 and a range of 7 to 10. Anecdotally, missed classes were attributed to elevated general medical issues, physical pain, psychological distress symptoms, childcare, and/or schedule conflict. Mean weekly home practice was 6.4 hours with a SD of 4.6 hours and a range of 2.4 to 17.7 hours.

Preliminary Efficacy Evaluation: Attention and PTSD Outcomes

The effect size for enhanced attentional abilities was in the medium range for the baseline timepoint compared to immediately post-MBSR, t(8) = −2.4, p = 0.045, d = −0.57, 95% confidence interval (CI) = −0.76 to −0.012 and remained in the medium range at 3-months post-MBSR, t(7) = −2.0, p = 0.088, d = 0.48, 95% CI = −0.60 to 0.05 (Table V). Greater time spent practicing mindfulness skills outside of class each week was correlated to improvements in attentional abilities (difference score between attention performance immediately after the MBSR class and baseline), Pearson’s correlation coefficient, r(7) = 0.74, p < 0.050.

Effect sizes for decreased PTSD symptoms were in the large range for the baseline timepoint compared to immediately post-MBSR, t(8) = 4.1, p = 0.004, d = −1.56, 95% CI = 2.79 to 10.21, and remained large for the 3-months post-MBSR assessment, t(7) = 4.1, p = 0.046, d = −0.93, 95% CI = 0.14 to 10.43 (Table V). In regards to the number of participants that experienced a reduction in symptoms was 63.6 (14.2) to 57.1 (15.2) was 8.3 out of 10 with a SD of 1.2 and a range of 7 to 10. Anecdotally, missed classes were attributed to elevated general medical issues, physical pain, psychological distress symptoms, childcare, and/or schedule conflict. Mean weekly home practice was 6.4 hours with a SD of 4.6 hours and a range of 2.4 to 17.7 hours.

TABLE III. The Extent to Which Different Components of the Program Were Thought Useful and Beneficial

<table>
<thead>
<tr>
<th>Program Component</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Scan</td>
<td>7.1</td>
<td>3.0</td>
<td>1–10</td>
</tr>
<tr>
<td>Sitting Meditation</td>
<td>7.4</td>
<td>2.1</td>
<td>4–10</td>
</tr>
<tr>
<td>Yoga and Gentle Stretch</td>
<td>9.1</td>
<td>1.1</td>
<td>7–10</td>
</tr>
<tr>
<td>In Class Guided Meditation</td>
<td>9.1</td>
<td>1.2</td>
<td>7–10</td>
</tr>
<tr>
<td>Group Discussions</td>
<td>7.6</td>
<td>2.5</td>
<td>3–10</td>
</tr>
</tbody>
</table>

Participants rated each component of the class on a response scale that ranged from 1 (No use at all) to 10 (Very useful).

TABLE IV. Sample Responses Provided by Participants to a Questionnaire After Completing the MBSR Class

<table>
<thead>
<tr>
<th>Question</th>
<th>Sample Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have There Been Any Specific Positive Changes in Your Medical Condition?</td>
<td>“Much slower lifestyle. I move in a manner much more compatible with being a 56 year old man with TBI, and still able to accomplish much.”</td>
</tr>
<tr>
<td></td>
<td>“I’m now aware of how much my attitude affects the pain level I feel.”</td>
</tr>
<tr>
<td></td>
<td>“Becoming more aware of my body, as a whole, has made me feel whole again. And it has helped immensely with my mental condition. I am much more readily accepting of people, places and things as they relate to me.”</td>
</tr>
<tr>
<td>Have You Made Any Changes in Your Lifestyle?</td>
<td>“I’m more mindful of my responses. I can feel the ‘little’ moment between my response. I’m much more relaxed.”</td>
</tr>
<tr>
<td></td>
<td>“I mindfully do a lot of things. Eating, driving, walking.”</td>
</tr>
<tr>
<td></td>
<td>“I confront head-on and not duck or go around problems. I confront them and try to walk with the problem- without losing my temper.”</td>
</tr>
<tr>
<td>What Was Your Most Significant Insight During the Program?</td>
<td>“That I can live a life that doesn’t have to involve constant crisis.”</td>
</tr>
<tr>
<td></td>
<td>“Noticing that I wasn’t noticing.”</td>
</tr>
<tr>
<td></td>
<td>“My most significant insight was how stress plays a part on the body and how relaxed I felt after the yoga, body scans and stretching we did in class. I was able to get rid of some pain around the neck and shoulders.”</td>
</tr>
</tbody>
</table>

TABLE V. Baseline and Post-MBSR Mean Scores (and Standard Deviations) on the Cognitive and Psychiatric Outcome Measures

<table>
<thead>
<tr>
<th>Measures</th>
<th>Baseline</th>
<th>Immediate Post-MBSR</th>
<th>Effect Size*</th>
<th>3 Months Post-MBSR</th>
<th>Effect Size*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>0.00 (1.00)</td>
<td>0.26 (0.88)</td>
<td>0.57**</td>
<td>0.18 (0.95)</td>
<td>0.48*</td>
</tr>
<tr>
<td>PCL-C</td>
<td>63.6 (14.2)</td>
<td>57.1 (15.2)</td>
<td>−1.56**</td>
<td>58.6 (16.7)</td>
<td>−0.93**</td>
</tr>
</tbody>
</table>

Attention measure represents standard scores derived from subtests of the Cogstate computerized battery. Reported baseline mean and standard deviation are for all participants, whereas effect size and t-test calculations are based on a pairwise exclusion of missing data for each analysis.*Denotes p value calculated by paired t test as compared to baseline <0.100. **Denotes p value calculated by paired t test as compared to baseline <0.050. “Denotes Cohen’s d effect size as compared to baseline for within-participants correction for dependence among means.”

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following MBSR, research by the National Center for PTSD defines a reliable change in PCL-C score as at least a 5 point difference in total score. Six of nine participants experienced at least a 5 point decrease in PCL-C score immediately following MBSR as compared to baseline measurement, and three of eight participants experienced at least a 5 point decrease in PCL-C score at 3 months after completion of MBSR as compared to baseline measurement. Mean time spent practicing mindfulness skills outside of class each week was not correlated to PTSD symptom reduction.

**DISCUSSION**

This single-arm pilot study of MBSR in Veterans with mTBI history and comorbid PTSD with chronic cognitive complaints suggests high levels of safety, acceptability, and feasibility. In regards to safety, there were no adverse effects from participation in MBSR observed or reported, and no appreciable increases in PTSD symptoms. In terms of acceptability, qualitative interviews, and quantitative self-report responses revealed that all participants enjoyed the program and described improvement in one or more medical or mental health related issue(s). In terms of feasibility, all participants’ class attendance and completion of home practices and assignments met the minimal a priori established criteria. Thus, this study provides initial evidence that a mindfulness-based intervention can be safe, acceptable, and feasible in a population with concurrent psychiatric and neurocognitive symptomatology.

An important specific finding with regards to acceptability highlights the advantage of having diverse and varied mindfulness practices (i.e., body scan, sitting meditation, yoga, and gentle stretch). Table III indicates that although all of these components of MBSR were overall well received, the large range in ratings clearly indicates that some techniques highly resonate with one participant while not at all with another. Thus, the heterogeneity of techniques is important so as to bolster acceptability, as well as potential efficacy, of this intervention for a wider and more diverse range of participants.

The current study also specifically investigated the potential efficacy of MBSR in the presence of concurrent neurocognitive and psychiatric symptoms. Many previous studies have revealed the challenges and reduced efficacy in conducting psychotherapy or cognitive rehabilitation in the presence of concurrent neurocognitive and psychiatric symptomatologies, but the potential efficacy of a mindfulness-based intervention in this type of population has not yet been directly examined. To this end, there are two notable findings from the current study. First, preliminary findings of efficacy in the outcome variables with effect sizes in the medium to large range suggest that the comorbidity of concurrent cognitive and psychiatric symptoms does not serve to squelch the beneficial effects of mindfulness training in this population. Second, the mindfulness-based intervention was found to have potential efficacy to improve attentional abilities and reduce psychiatric symptomatology simultaneously. Research on mindfulness training thus far indicates efficacy in improving cognition or psychiatric symptoms individually. The current study suggests that mindfulness-based interventions may be efficacious for both concurrently, which is particularly advantageous for populations with psychiatric and cognitive comorbidities.

The unusually broad effects of mindfulness training are noteworthy, and may be attributable to elements of the practice that are largely unique to mindfulness training. More specifically, the core practice entails repeated, volitional, nonjudgmental return to the object of mindful attention (e.g., breath, somatic sensations) following derailment from the object of mindful attention by thoughts, emotions, sensations or external stimuli. This process of return is exerted by the individual time and time again, within each mindful session, and across the course of at least several weeks of practice. Numerous studies show an increase in operationally defined measurements of mindfulness following this type of training, thus suggesting a strengthened ability to refocus attention away from the persistent stream of thoughts and emotions, back to the present moment. As might be anticipated, this ability to refocus and be mindful has been shown to be associated with enhanced attentional and emotional regulation. Primary contributory mechanisms to enhanced emotional control likely include decreased rumination, cognitive reactivity, experiential avoidance, and increased self-compassion, as each has been shown to correlate with increases in measured mindfulness. In regards to attentional control, neurocognitive and neuroimaging studies have made progress in understanding the ways by which mindfulness training enhances core aspects of attentional abilities and the corresponding attentional network in the brain. For instance, increased activation and cortical thickness in the anterior cingulate, a central component of the attention network, has been observed in association with enhanced attentional control following different forms of mindfulness training.

The findings of this study should be considered in the context of the following important limitations. In the absence of a randomized, controlled design, we cannot rule out the possibility that participants would have improved without treatment or by simply attending a group with a facilitator, rather than because of the MBSR class specifically. Given that the effect sizes were in the moderate to large range for the outcome measures and gains were largely maintained at the 3-month post-MBSR timepoint, the intervention as a whole appears to be associated with improvement in PTSD symptoms and attentional ability, and follow-up studies will be important to delineate the specific and non-specific factors with effects. Also, although no safety concerns were observed in this study, the small size of this pilot may have prevented the identification of uncommon, but important, adverse events associated with MBSR in this population. Careful monitoring of any potential side-effects would be warranted in future studies. Features of the health

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care system in which this intervention was delivered may have contributed to the retention and compliance rates observed. Specifically, participants enrolled in this study all receive continuous health care at the facility at which the MBSR program was offered. Thus, potential barriers that might be present in other settings, such as lack of familiarity and perhaps comfort, might result in lower levels of enrollment, participation, and completion. Similarly, appointment reminders perhaps improved level of participation more than might have been observed otherwise. In fact, given the increased propensity for cognitive lapses in this population, appointment reminders might be an ideal component to retain for protocols with this population. Another potential limitation is that medical records are typically not available following a mTBI event because medical attention is often not sought. Thus, TBI history was obtained from participant self-report, which can have inaccuracies. As such, assessment of TBI history (e.g., duration of loss of consciousness and posttraumatic amnesia) was not utilized to quantify extent of mTBI history, but only to dichotomously determine whether or not a mTBI was sustained.

In conclusion, the current study provides promising findings related to the use of MBSR for patients with concurrent neurocognitive and psychiatric symptomatology, thus warranting a randomized controlled trial follow-up. Given the prevalence of comorbid neurocognitive and psychiatric issues present in military and Veteran populations, and particularly those returning from Iraq and Afghanistan, MBSR (and potentially other mindfulness-based interventions as well) could prove to be an important adjunctive therapy for this sometimes treatment refractory population.

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MBSR for Cognitive and Psychiatric Symptoms


