

Mindfulness-based Mind Fitness Training: A Case Study of a High-Stress Predeployment Military Cohort

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Current military deployments have resulted in many psychological and physical health issues and created interest in protective measures to mitigate effects of prolonged and repetitive stress. Mindfulness training has been successfully used for stress reduction in other contexts. The following case report presents a detachment of U.S. Marines who received Mindfulness-Based Mind Fitness Training (MMFT) prior to deployment. Self-report measures of mindfulness, perceptions of stress, predictors of compliance with mindfulness practice, and time spent engaging in practice were indexed. More time spent engaging in practice corresponded with greater self-reported mindfulness; increases in mindfulness were associated with decreases in perceived stress.

THE demands of multiple deployments have resulted in a broad range of psychological and physical health challenges related to prolonged exposure to stressful environments in military service-members (Mental Health Advisory Team [MHAT], 2008). While the stressors of military deployment are widely recognized (Adler, McGurk, Stetz, & Bliese, 2003; King, King, Vogt, Knight, & Samper, 2006), comparatively less is known about effective methods for buffering against stress-related dysfunction and disease. The suffering of veterans of recent deployments, compromised effectiveness of the fighting force, and high costs of caring for combat veterans with stress-related ailments have motivated the military to investigate training programs to bolster psychological resilience as a prophylaxis against deployment stressors.

Mindfulness training (MT) has emerged as an efficacious approach for reducing stress in a variety of civilian contexts (Grossman, Niemann, Schmidt, & Walach, 2004) and as a useful component in treating clinical populations (Baer, 2006). MT protocols aim to bolster mindfulness—a mental mode characterized by full attention to present-moment experience without judgment, elaboration, or emotional reactivity. This case report presents a cohort of U.S. Marine reservists who received a novel MT intervention tailored for the military context, referred to

as Mindfulness-based Mind Fitness Training (MMFT), as they prepared to deploy to Iraq.

The Deleterious Effects of Stress for the Military

Military service is an inherently stressful profession. Service-members are expected to deal with significant and potentially traumatizing stressors before, during, and after deployment, including threats to individual safety, the need to inflict harm on others, and exposure to injury, death, and significant human suffering (Adler et al., 2003). Ample evidence suggests that troops may experience considerable anxiety and distress in anticipation of deployment (Bolton, Litz, Britt, Adler, & Roemer, 2001; MacDonald, Chamberlain, Long, Pereira-Laird, & Mirfin, 1998), which may place them at higher risk for mental health problems after deployment (Maguen et al., 2008). Deployment presents additional stressors, such as difficult living conditions, boredom, and family separation; recent research demonstrates a strong association between mental health disorders and such lower-magnitude deployment stressors (King et al., 2006). Multiple deployments exact a high toll, including lower morale, more mental health problems, and more stress-related work problems (MHAT, 2008). In addition, combat exposure has been linked to a range of negative health consequences, including posttraumatic stress disorder (PTSD; Kaylor, King, & King, 1987), depression (Erickson, Wolfe, King, King, & Sharkansky, 2001), substance abuse (Boscarino, 1981), and physical health problems (Taft, Stern, King, & King, 1999).

Service-members returning from recent deployments report a broad range of concerns. Physiological concerns include disturbed sleep habits, low energy, headaches, chronic pain, cardiopulmonary symptoms, and gastrointestinal difficulties (Levin, 2007; Scaer, 2008). Psychological concerns include PTSD, traumatic brain injury, depression, and anxiety disorders (Milliken, Auchterlonie, & Hoge, 2007; Tanielian & Jaycox, 2008). Complicating matters, PTSD is frequently comorbid with other psychological problems (Tanielian & Jaycox) and is also linked to physical problems (Hoge, Terhakopian, Castro, Messer, & Engel, 2007). These myriad dysfunctions are frequently labeled as independent issues and treated separately, but an emerging alternative perspective conceives of these disparate disorders as a spectrum of responses to prolonged or extreme stress rather than as illnesses with unrelated causes (Herman, 1992; Scaer, 2005; van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola, 2005).

Yet, trauma research suggests that pathology is actually the exception rather than the normal response to overwhelming experience; most people display resilience despite adversity (Bonanno, 2008; van der Kolk, 2002). Resilience is conceived of as an individual's ability to move through significant or chronic stress and display adaptive psychobiological allostasis (Feder, Nestler, & Charney, 2009; Haglund, Nestadt, Cooper, Southwick, & Charney, 2007). Resilience has also been conceptualized as the ability to maintain healthy functioning in the face of increasing stressors and demands, as well as the capacity to recover to full functioning following a period of intensive demands. Recent studies suggest that resilience as individual characteristics or skills could be cultivated or enhanced to confer protection from overwhelming experience (Feder et al., 2009; Haglund et al., 2007). If so, receiving training to cultivate resilience in the predeployment interval may help protect against the deleterious effects of the high-stress military context on physical and psychological health. In the current study, we investigate the impact of mindfulness training as a form of resilience training.

The Utility of Mindfulness

Eastern contemplative traditions have long held that cultivating a specific mental mode known as mindfulness gives rise to enhanced well-being. In the West, interest in mindfulness has mushroomed in recent decades, and efforts to define, measure, and test mindfulness have gradually developed a construct that connects mindfulness training with positive physical and mental health outcomes (Grossman et al., 2004). Mindfulness involves "bringing one's attention to the present experience on a moment-by-moment basis" (Marlatt & Kristeller, 1999, p. 68).

There is now considerable evidence of the effectiveness of mindfulness-based interventions at reducing distress (Baer, 2003; Grossman et al., 2004). The most common and well-validated MT program is mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1990). In addition, MT has been incorporated as a component in clinical interventions for a range of disorders, including borderline personality disorder (Linehan, 1993), substance abuse (Witkiewitz, Marlatt, & Walker, 2005), recurrent depression (Segal, Williams, & Teasdale, 2002), eating disorders (Kristeller, Baer, & Quillian-Wolever, 2006), generalized anxiety disorder (Roemer & Orsillo, 2002), and posttraumatic stress (Wolfsdorf & Zlotnick, 2001). Prior clinical studies have also suggested that MT may help provide "psychological prophylaxis" (Teasdale et al., 2000). Recently, studies report that MT can increase mindfulness and that increases in mindfulness mediate decreases in perceived stress and increases in well-being (Carmody & Baer, 2008; Shapiro, Oman, Thoresen, Plante, & Flinders, 2008). Importantly, these studies emphasize that beyond simply having received MT, a critical factor in determining if salutary effects are observed is the amount of time spent engaging in mindfulness practice.

Promoting Stress Resilience in Military Cohorts With Mindfulness Training

The current study was a nonclinical (Phase I) feasibility study, involving the adaptation of mindfulness training to promote psychological resilience in predeployment military service-members. Providing training to help military personnel manage stress before deployment may help them function more effectively while deployed and perhaps ameliorate the long-term health effects of the deployment itself. Moreover, recent reviews of resilience literature suggest that a willingness to face fears, the presence of positive emotions, the ability to attend to unpleasant stimuli, exposure to stressful experiences that are modestly destabilizing but are not overwhelming, and the capacity for cognitive flexibility, reappraisal, acceptance, and emotion regulation all contribute to resilience (Feder et al., 2009; Haglund et al., 2007). Considering these factors in light of the beneficial effects observed with MT, a mindfulness-based approach appears well-suited for promoting resilience and merits investigation.

At least three unique features of the predeployment military setting demonstrate the need to adapt MT specifically for this context. First, unlike civilian MT interventions, where participants enroll on an individual basis, incorporating MT into the predeployment context requires integrating MT into a unit's organizational setting and ongoing training. Thus, the MT course must address both power hierarchy and organizational group dynamics, as personnel of different ranks and positions in

the command hierarchy receive the training together. Second, unlike civilian MT interventions, where participants seek out the training on their own, troops are not necessarily seeking MT and may feel resistance towards participating. Thus, to counter possible resistance, the MT course needs to build troops' motivation for engaging in mindfulness exercises outside of class by including more didactic material to make MT skills accessible and applicable to the military mission. This necessitates displacing some in-class MT instruction usually included in MT interventions to make room for additional didactic material about stress, resilience, and operational applications. Finally, troops need to maintain optimal functioning during ongoing stress inoculation training, which is a significant part of predeployment training itself, while also preparing for the future challenges of deployment. Stress inoculation training exposes troops to stressors they are likely to experience during deployment, to help troops perceive these stressors as more familiar, predictable, and controllable. This necessarily requires extending MT's goal from merely reducing stress to promoting stress resilience.

These differences in context necessitated a novel MT intervention tailored for enhancing performance and building resilience in the predeployment military setting: MMFT. What follows is the case of a cohort of U.S. Marine reservists who received MMFT as they prepared to deploy to Iraq. As such, this case report is a first exploration to assess feasibility of delivering an adaptation of MT in the predeployment context, to see if participants would complete MT exercises and what effects the training might have. Thus, we were interested in examining changes in self-reported mindfulness and perceived stress before and after participation in the course. Among those who fully engage in the training exercises: (a) does MMFT increase self-reported mindfulness and (b) does MMFT reduce levels of perceived stress, as has been reported in prior studies of MT (Carmody & Baer, 2008)?

Because previous research has demonstrated that mindfulness scores mediated stress reduction and improvements in well-being and mood (Carmody & Baer, 2008; Shapiro et al., 2008), we predicted that changes in mindfulness scores might similarly correspond with reductions in perceived stress in MMFT participants. However, civilian MT courses are taught in the context of relatively constant stressors over time, while the predeployment period includes stressors increasing over time. Indeed, we expected the predeployment period to show two sources of increased stressors: not only would the Marines likely experience considerable mood disturbance and distress in anticipation of the deployment and separation from their families (Bolton et al., 2001; MacDonald et al., 1998; Maguen et al., 2008), but the mandatory predeployment stress inoculation training

may itself be stressful (Lieberman et al., 2005; Morgan, Doran, Steffian, Hazlett, & Southwick, 2006).

Thus, based on MBSR studies reporting a negative correlation between mindfulness scores and stress (Carmody & Baer, 2008; Shapiro et al., 2008), we predicted that the presence of predeployment stressors in our military cohort might result in decreases in mindfulness scores and increases in perceived stress, even with MMFT. For this reason, we gathered data from a separate detachment within the same parent unit as a no-training Marine comparison (MC) group, to determine the changes in mindfulness and stress that may result over the course of predeployment training in the absence of MT. In addition, based on several previous reports on the correspondence between MT practice duration and beneficial effects on attention (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007), working memory capacity and emotion regulation (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010), and affect (Carmody & Baer, 2008), we expected a relationship between the amount of MT practice time and changes in mindfulness scores and stress.

In light of these previous studies, we predicted that even if overall mindfulness scores decreased and perceived stress scores increased over time, a higher degree of compliance in engaging in out-of-class mindfulness exercises would correspond with higher mindfulness scores and lower perceived stress scores at T2. In other words, we predicted that at T2 for those who practiced more, their mindfulness scores would be higher, and their perceived stress scores lower, than for those who practiced less and for those who did not receive MMFT (the MC group). Yet, because previous studies found that MT's beneficial effects are linked to the amount of time engaging in MT outside of class, rather than to participation in an MT course per se (Carmody & Baer, 2008; Jha et al., 2010), we were uncertain whether the scores of those who practiced less would differ at T2 from those who did not receive MMFT (the MC group).

Finally, given growing evidence that MT's salutary benefits are linked to time spent engaging in mindfulness exercises (Brefczynski-Lewis et al., 2007; Carmody & Baer, 2008; Jha et al., 2010), we were also interested in examining demographic and personality variables and overall impressions of the MMFT course that might correspond to greater practice time. To our knowledge, no studies have examined predictors of MT practice.

Case Report

The Group as a Case

While case reports traditionally focus on the treatment of an individual or small group, this case report focuses on the detachment of 34 U.S. Marine reservists who received MMFT. The detachment is appropriate for analysis as a single case for two reasons. First, MMFT was designed to

be offered to existing military units, in their group setting, taking account of both rank hierarchy and organizational group dynamics, and many MMFT exercises were designed as group exercises, to be completed in teams. In addition, MMFT's didactic material makes clear how the skills taught relate to the organization's mission, with examples applied to the operational environment. Second, one important motivation for MMFT being offered to the group is to enhance unit cohesion and social support, both factors associated with resilience (Haglund et al., 2007; King et al., 2006; Maguen et al., 2008). With this in mind, the course explores how mindfulness is a foundational skill for effective interpersonal communication, which can improve unit cohesion, and how the shared experience of undertaking MMFT as a group could build informal relationships and solidarity. We expected that teaching MMFT to existing organizational groups and framing it in terms of its ability to optimize unit performance would help to bypass the potential for stigma about stress resilience training with a military audience. In light of the group's centrality to MMFT's design, the ability to assess its overall effectiveness required examining the group that participated in the training *as a group*. Thus, in addition to assessing the training's effects at the individual level, we also sought to determine its effectiveness at the group level through anonymous surveys and informal interviews with the participants before and after their deployment to Iraq.

Group Characteristics and History

Thirty-four male participants (mean age = 30, $SD = 7.8$), ranging in rank from Lance Corporal to Major, were recruited from a detachment of U.S. Marine Corps reservists to complete the 8-week MMFT course. MMFT was taught on-site at the unit's training locations. The Marines were divided into two class groups of 17, organized around the unit's teams, which remained constant throughout the course. A separate detachment of 21 male participants (mean age = 25, $SD = 4.3$) from within the same parent unit was examined as the MC group. The MC group was included to determine the changes in mindfulness and stress that may result over the course of predeployment training in the absence of MT. Note that this feasibility study was not conducted as a randomized trial, and while a comparison group was examined, they were not extensively matched to the MMFT group on an exhaustive set of parameters. Instead, they were matched only on the basic parameters of being an intact detachment undergoing predeployment training from the same parent unit as the MMFT group. None of the participants in either group had prior experience with mindfulness techniques.

Within the MT group, there were four commissioned officers (O-3 to O-4), one warrant officer, 14 noncom-

missioned officers (E-5 to E-9), and 15 junior enlisted Marines (E-4 and below). Twenty-one of the 34 Marines (62%) had deployed to Iraq before, with prior combat deployments ranging from once to three times, although one Marine had also deployed six times as a private military contractor. In addition, 38% of the men in this reservist detachment held high-stress civilian occupations, including law enforcement (e.g., SWAT teams and narcotics detectives), firefighting, and emergency medical care in large metropolitan regions.

Two-thirds of the Marines with prior deployments, and half of the Marines with high-stress civilian occupations but without prior deployments, shared during mandatory 15-minute individual interviews with the instructor that they were experiencing symptoms of distress as a result of traumatic experiences, either during prior combat deployments or their high-stress civilian occupations; 59% expressed having experienced such symptoms, including intrusive thoughts, flashbacks, nightmares, avoidant coping mechanisms, isolation, marital difficulties, alcohol and substance abuse, high-risk adrenaline-seeking behaviors, obsessive-compulsive behaviors, memory loss, difficulty concentrating, irritation, anger, depression, anxiety, survivor guilt, grief, insomnia, gastrointestinal difficulties, and muscle tension. In line with research about stigma in the military regarding mental health care (Greene-Shortridge, Britt, & Castro, 2007), many Marines admitted to withholding information on assessment tools administered by the military after their previous deployments, for fear of professional repercussions and stigma. Even so, two of the Marines said they sought mental health care provided by the Veterans' Administration (VA) for posttraumatic stress disorder and anxiety disorder after prior deployments. Both men were given prescriptions and one was enrolled in group therapy with the VA; however, both men dropped out of treatment shortly thereafter, because they claimed it was not helping with their symptoms.

Both these preexisting, untreated symptoms and the fact that the Marines admitted to withholding certain information on military-administered assessment tools speak highly to the stigma that still exists within the military regarding psychological health care. Although we did not know about these group characteristics at the time the training was created, the effect of stigma was an important consideration in framing MMFT for participants in terms of its ability to enhance unit effectiveness during deployment rather than as a psychological health treatment.

Assessment Procedures

Our aim was to assess changes in self-reported mindfulness and perceived stress before and after the

MMFT course, as a function of how much time individuals spent engaging in mindfulness exercises outside of class. The instruments used to assess the training's effects were delivered during two testing sessions for both the MMFT and MC groups. All testing was conducted at the units' locations, with individual laptop testing stations, separated by dividers to minimize visual distraction and noise. Participants completed a battery of self-report questionnaires, including the Five Facet Mindfulness Questionnaire (5FMQ; Baer et al., 2006), Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), Personal Outlook Scale (POS; Bodner & Langer, 2001), and other instruments outside this article's scope. The study was approved by the University of Pennsylvania Institutional Review Board; informed consent was obtained from each participant prior to entry into the study and safeguards were taken to ensure confidentiality.

We indexed the training's effects on mindfulness by using the 5FMQ, which comprises five subscales that measure observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience. Each item is rated on a scale from 1 (*never or rarely true*) to 5 (*very often or always true*). The 39-item instrument includes such items as "I find myself doing things without paying attention" and "When I do things my mind wanders off and I'm easily distracted." Higher scores reflect greater levels of mindfulness.

We selected the PSS to index the participants' responses to the high stress predeployment environment. The PSS is a 14-item instrument used to index the degree to which situations in one's life within the past month are viewed as stressful. Using a scale from 0 (*never*) to 4 (*very often*), participants were asked to rate such items as "In the last month, how often have you found that you could not cope with all the things that you had to do?" and "In the last month, how often have you felt nervous and 'stressed'?" Higher scores reflect greater perceived stress.

Participants in the MMFT group were instructed to complete 30 minutes of "homework" each day, practicing MT exercises with and without audio CDs. This homework was comparable to that given in MBSR courses but was frequently completed in a group setting and in short sessions throughout the day. To assess compliance, participants in the MMFT group completed practice logs to self-report the amount of time they spent out-of-class engaging in the weekly homework assignments. Participants were encouraged to be completely candid and accurate in reporting their practice times. Importantly, the instructor did not have knowledge of individual practice logs. Practice duration was indexed using each participant's reported minutes of practice outside of class. The total number of reported minutes ranged from 25 to 1,685 ($M=400.76$; $SD=377.69$), far fewer minutes than instructed, which suggests participants were candid in

their self-reports. To reduce a severe right skew in the distribution of minutes of practice, analyses were conducted using the square root of each participant's total minutes of practice; we refer to this transformed measure as Practice Time.

Because growing evidence links MT's salutary benefits to time spent engaging in mindfulness exercises (Carmody & Baer, 2008), we were interested in determining which factors might correspond to Marines completing MT exercises outside of class. We examined if any of the following demographic variables corresponded to MT Practice Time: education, military rank, marital status, and prior deployments. We also examined if Practice Time, over the 8-week interval, corresponded to scores on the Personal Outlook Scale (POS; Bodner & Langer, 2001), which was completed prior to MT, at T1. The POS is a 21-item instrument that asks participants to rate their agreement with statements about personal outlook on a scale from 1 (*strongly agree*) to 7 (*strongly disagree*). It is the precursor to the Langer Mindfulness Scale (Langer, 2004). It includes items such as "I like to be challenged intellectually" and "I'm always open to new ways of doing things." The POS, as described by its developer, is meant to assess individual differences in a person's propensity to be novelty-seeking, novelty-producing, engaged, and flexible. A person who scores high on novelty-seeking is likely to perceive each situation as an opportunity to learn something new. A person who scores high on engagement is likely to notice more details about his or her specific relationship with the environment. A person who scores high on novelty-producing is likely to generate new information in order to learn more about the current situation. A person who scores high on flexibility is likely to welcome a changing environment rather than resist it.

We also inquired about participants' attitudes toward MMFT, as part of our interest in determining feasibility. At the second time-point, participants completed a survey regarding their experience with and attitudes about MMFT. We created a composite score that tallied their responses, on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*), to three questions: (a) "I learned valuable skills in this course;" (b) "I will use skills I learned in this course down range;" and (c) "I would recommend that others in the military take a similar course."

Finally, in addition to assessing the training's effects at the individual level, we sought to determine its effectiveness at the individual and group level through anonymous surveys and informal interviews with the participants before and after their deployment to Iraq. Paper-and-pencil surveys were given during testing sessions, focus-group discussions were audio-recorded, and interviews with individual participants were video-recorded and later transcribed. We asked participants whether and how group dynamics changed as a result of the training.

Training

MMFT: Similarities and Differences to MBSR

MBSR is an 8-week group intervention that is largely skill-based (Kabat-Zinn, 1990). The 24-hour course includes weekly 2-hour sessions, with one day-long retreat during the sixth week. Participants are also instructed to complete up to 45 minutes of “homework” each day, using CDs at home to guide them through mindfulness practices. Any didactic material presented comes from a “bottom-up” format, with insights emerging from the group discussion rather than as “top-down” presentations from the instructor. Participants seek out and join the MBSR course on an individual basis; for this reason, the group develops its personality through the course, rather than having existed beforehand. This mix of strangers drawn together for a common purpose often leads MBSR courses to develop rich group discussions, as participants are generally willing to share about their experiences and insights from mindfulness practice.

MMFT (pronounced “M-Fit”) was created and delivered by the first author, a former U.S. Army officer with many years of mindfulness practice and training in MBSR and trauma resilience. While MMFT matched many features of the MBSR protocol, there were also significant adaptations for the military context.

Format

Similar to MBSR, MMFT involved 24 hours of class instruction over 8 weeks with weekly 2-hour meetings (on average) and a full-day silent workshop. The course also required up to 30 minutes of mindfulness practice daily outside of class using CDs created by the instructor specifically for this cohort. The recorded exercises, ranging from 10 to 30 minutes, were shorter than MBSR's recorded exercises. To accommodate the military training schedule, class sessions varied in terms of session length, time of day, and location. During the third and fourth weeks, each participant completed one mandatory 15-minute personal interview with the instructor about his progress with mindfulness techniques.

As noted, MMFT was taught on-site at the unit's various training locations. Because of conflicts with their pre-deployment training field exercises, 12 Marines missed some of the class sessions. Some Marines were able to attend make-up classes with the other group, while others received personal instruction through phone interviews. Thus, all 34 participants received all course instructions and content.

Content

In addition to the topics discussed in MBSR, MMFT covered topics of central relevance to this population, tailored for military predeployment training. New didactic content was added to highlight parallels between

physical and mental fitness for deployment readiness, and context created with real-world examples from the counterinsurgency environment. The course also added a stress resilience skills section, drawing on concepts from sensorimotor regulation (Ogden, Minton, & Pain, 2006), Somatic Experiencing (Levine, 1997) and the Trauma Resilience Model (Leitch, 2007; Leitch, Vanslyke, & Allen, 2009), which provided specific guidance for using focused attention to reregulate physiological and psychological symptoms following an experience of extreme stress. Thus, MMFT blended (a) mindfulness skills training with (b) concrete applications for the operational environment and (c) information about stress, trauma, and resilience in the body. MMFT's novelty rested in this synthesis.

In order to include this additional didactic material about concrete military applications and stress resilience, the in-class MT instruction was necessarily decreased. As a result, the MMFT course included about 12 hours of MT instruction to introduce and practice mindfulness techniques and discuss participants' questions; 6 hours of didactic instruction and skills training related to stress, resilience, and trauma; 5 hours of didactic instruction and discussion about military applications; and 1 hour for breaks and administrative issues.

To highlight the integration of these three components, each class session consisted of didactic instruction, a group discussion about didactic topics applied concretely to the deployment environment and participants' lives, and interactive mindfulness-based exercises. Unlike the regular MBSR course, however, much of the didactic material was presented in a “top-down” rather than “bottom-up” format. In contrast to the typical MBSR class roster, participants in this course not only knew and had worked with each other before this course began, but they knew they would have to deploy together, which made some of them wary about speaking about their personal experiences with the group. The instructor worked with this dynamic by presenting didactic material with interactive lectures and by focusing most group discussions towards applying MMFT skills to the unit's mission effectiveness rather than to the participants' personal lives. Nonetheless, some group discussions were very personal, especially those related to using MMFT skills for working with the traumatic effects of prior deployments.

Introduction and Order of Techniques

At first, exercises emphasized building concentration by focusing on one object of attention. This single focus of attention was to be maintained throughout the practice session; when attention wandered, it was to be returned back to the object of attention. The first exercise introduced included short periods of paying attention

to the contact between the feet and the floor while standing, and between the body and the chair and floor while seated. These contact point exercises lasted between 5 and 10 minutes. The next exercises required attending to body sensations during a modified, seated body scan and to body sensations during standing movement. Exercises introduced in the middle of the course included awareness of breathing and awareness of body sensations during seated movement. Each of these exercises initially lasted 20 minutes, with 30-minute variations introduced in the final third of the course. The final third of the course also introduced 10-minute exercises to “shuttle” the attention between inner sensations and outer experiences (i.e., sights or sounds) and to use focused attention to reregulate physiological and psychological symptoms that develop from stressful experiences.

As noted, each participant completed one mandatory 15-minute personal interview with the instructor during the third and fourth weeks of the course. These interviews allowed Marines to share their personal histories and discuss any symptoms of trauma or distress they were experiencing. The instructor used these mandatory interviews and optional follow-up interviews to tailor each Marine's progression of the exercises to accommodate any exposure sensitivities.

Results

Between Group Analyses of Variance

In the MMFT group, one subject was excluded from the analyses for failure to submit any practice logs and three subjects for failure to complete both testing sessions. Four subjects from the control group were excluded for failure to follow task instructions. Thus, the final quantitative analysis included 30 MMFT participants (mean age=29, $SD=7.6$) and 17 MC participants (mean age=25, $SD=4.3$) with no significant differences in age across groups.

Training-Related Changes in Mindfulness

A mixed analysis of variance (ANOVA) was conducted to determine if there were training-related increases in mindfulness. It was not feasible to use a continuous measure of Practice Time in examining training-related effects, because the MC participants received no intervention and have no such measure. As such, a repeated measures ANOVA was conducted to examine the effects of practice by group. Since past research suggests that the amount of practice time corresponds to the degree of changes in self-reported mindfulness (Carmody & Baer, 2008; Shapiro et al., 2008), the MMFT group was parsed into Low Practice and High Practice subgroups by performing a median split of Practice Time. Thus, the ANOVA had a within-subjects factor of Time (T1 vs. T2)

and a between-subjects factor of Group (MC vs. High Practice vs. Low Practice). We also conducted paired contrasts (t tests) to assess differences between groups at each time-point, as well as within each group over time.

The ANOVA for 5FMQ revealed no main effect of Time ($p>.19$) and no main effect of Group ($p>.29$), but there was a significant Time x Group interaction, $F(2, 48)=7.18, p<.01$. Paired t -tests revealed no significant group differences at T1 ($p>.58$). At T2, the High Practice group scored significantly higher than both the Low Practice [139.60 vs. 122.67; $t(1, 28)=-2.79, p<.01$] and MC [139.60 vs. 127.59; $t(1, 30)=-2.03, p=.05$] groups, and the Low Practice and MC groups did not differ from one another ($p>.23$). Further, the High Practice group's scores increased significantly over time [131.60 vs. 139.60; $t(1, 14)=-2.39, p<.05$], while the Low Practice group's scores decreased significantly [132.47 vs. 122.67; $t(1, 14)=3.45, p<.01$], and the MC group's scores showed a trend towards decreasing (134.53 vs. 127.59; $p=.09$) (Fig. 1).

Training-Related Changes in Perceived Stress

A similar mixed ANOVA was conducted for the PSS. This ANOVA revealed neither a main effect of Time ($p>.61$) nor of Group ($p>.43$), nor a Time x Group Interaction ($p>.16$).

Correlations Within the MMFT Intervention Group

To mitigate some of the shortcomings of group dichotomization, as used in the ANOVA (High vs. Low Practice Time), we conducted correlations including the continuous variable Practice Time and the instruments 5FMQ and PSS. Since prior studies suggest that training-related changes of self-reported mindfulness (indexed by 5FMQ scores) may mediate MT-practice-related improvements in psychological variables (Carmody & Baer, 2008), we examined correlations between all variables.

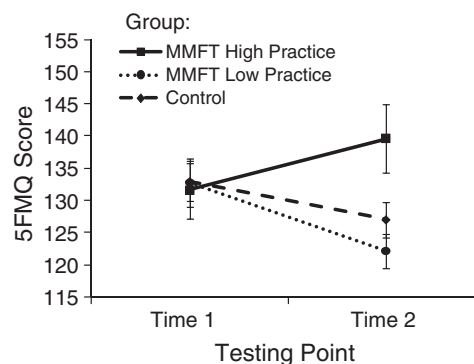


Figure 1. Scores on the Five Facet Mindfulness Questionnaire (5FMQ), at Time 1 and Time 2, for the MMFT High and Low Practice and Marine Comparison (Control) Groups. Error bars represent one standard error above and below the mean.

These correlation analyses with Practice Time were only performed in the MMFT group (because the MC group had no measure comparable to Practice Time). We examined correlations between Practice Time and change scores (difference between T2 and T1) in the PSS and 5FMQ. Table 1 shows Practice Time was not significantly correlated with PSS change scores but was correlated with 5FMQ change scores, $r(28) = .37, p < .05$. Importantly, 5FMQ change scores were significantly correlated with PSS change scores, $r(28) = -.46, p < .01$.

Thus, overall 5FMQ change scores (from T1 to T2) were significantly correlated with Practice Time as well as PSS scores (see Table 1). Although we did not have any a priori reason to expect that any particular 5FMQ subscale change score (from T1 to T2) would be more robustly associated with Practice Time or PSS than any other, we examined this possibility post-hoc. No 5FMQ subscale change scores were significantly correlated with Practice Time. However, Nonjudging of Experience did have a near significant correlation, $r(28) = .28, p = .13, p < .07$, one-tailed. In addition, both Nonjudging of Experience, $r(28) = -.38, p = .039$, and Acting with Awareness, $r(28) = -.50, p = .005$, subscale change scores were also significantly correlated with change in PSS.

Analysis of Factors Corresponding With Practice Time

Since there was significant variance in time spent engaging in MT across individuals in the MMFT group, we wished to explore which variables might correspond with the likelihood of engaging in mindfulness practice outside of class. We conducted a multiple regression with Practice Time as the dependent variable and independent variables including several demographic measures, the T1 POS score, and the composite survey response score. This regression showed Age ($p > .24$), Education ($p > .96$), Marital Status ($p > .12$), Military Rank ($p > .29$), and Number of Prior Deployments ($p > .12$) were all unrelated to Practice Time. The survey composite score was nearly significant [$b = .351, t(22) = 1.82, p = .08$], and the T1 POS score most significantly predicted Practice Time [$b = .412, t(22) = 2.09, p < .05$].

Table 1
Means, Standard Deviations and Correlations for all Variables

Variable	Mean	SD	1	2	3
1. Practice Time	17.85	8.48	-	.37*	-.05
2. Δ Time 5FMQ	-0.90	14.90		-	-.46**
3. Δ Time PSS	1.3	6.90			-

Note. $n = 30$; Values are for MMFT intervention group only; Practice Time refers to the square root of each participant's total reported minutes of mindfulness practice; Δ Time refers to the change in score over time (T2-T1); * $p < .05$; ** $p < .01$.

Qualitative Results Within the MMFT Intervention Group

We also sought to determine the training's effectiveness at the individual and group level through anonymous surveys and informal interviews with the participants before and after their deployment to Iraq. Many of these accounts reflected MMFT's perceived benefits at the individual and group level, although some Marines expressed frustration about needing to participate in the course and practice during the already overscheduled predeployment period. Each comment included here comes from a different participant and was selected for clearly stating a theme representative of the MMFT group's aggregate views.

At the individual level, Marines described new skills in focusing their attention (i.e., "I learned the ability to concentrate on one task at a time as well as identifying emotions and thoughts that detract from concentration"), as well as the ability to stay with difficult experiences (i.e., "I can deal with things better now, learn to just be with them" and "I can control myself without ignoring myself"). Some saw benefit from understanding the stress activation cycle and using focused attention to support the body's and mind's self-regulation of that cycle (i.e., "I learned the importance of allowing my body to 'reset' itself so that I can maintain a healthy baseline for my emotions"). Finally, many Marines stated that MMFT helped them work with difficult emotions and maladaptive coping behaviors after previous deployments (i.e., "I learned that one does not have to keep rage inside oneself. That facing these emotions was the only way to let them go" and "This course helped me face some of the behavior that I went through 4 years ago coming back from Iraq"). Married Marines also spoke about improvements in family life as a result of the training (i.e., "What I liked most about this course was how much calmer I became and how my relationship with my wife greatly improved").

At the group level, leaders and team members both noted improved team communication and unit cohesion. Leaders reported an improved ability to recognize emotions in themselves and others, which helped them to be more open to feedback from subordinates. They also reported improved self-knowledge (i.e., "This training helped me be a better leader. I know myself better now, my strengths and weaknesses. I am also better at reading my 'warning signs' of when I am getting stressed out, when I need to back off and get collected again"). Likewise, team members reported more awareness of individual strengths and weaknesses (i.e., the training "did help provide me with additional insight towards myself and others"), which led to more effective task delegation and more cooperative behavior within the team. They also reported more group efficacy in the face

of stressful experiences (i.e., the group “being more in control in chaotic situations” and “We can accept there is bad around you but you can deal with it”).

Several Marines expressed frustration about MMFT's delivery not having been well coordinated with other training, creating the perception that MMFT decreased off-duty time, and led some to resent having to participate in the course as well as to practice outside of class. Some Marines were overtly resistant to the training (i.e., “Do not [expletive] with my time off. We don't get enough and this [expletive] took some of it away” and “This is yoga and meditation, don't like it”). Other Marines said that while they believed MMFT was beneficial, the unit needed to create more time during the duty day for them to practice (i.e., “I think if taken properly it would be very beneficial, the goal is a very good one, but some things must change. More time for this should be allotted [sic] during the training days, not on our personal time”).

Discussion

In this study, we sought to explore the feasibility of MT during the predeployment military context. First, we sought to assess if MMFT could improve participants' levels of mindfulness, despite fewer hours of in-class MT instruction compared to a regular MBSR course. At the same time, preparing for deployment is stressful, with increases reported in negative mood, depression, and anxiety during the predeployment interval (Bolton et al., 2001; MacDonald et al., 1998). In light of other studies showing a negative correlation between mindfulness scores and stress and medical symptoms (Carmody & Baer, 2008; Shapiro et al., 2008), we investigated if mindfulness scores would decrease over the predeployment interval. We found this to be the case, with the Low Practice group's 5FMQ scores significantly decreasing and the MC group's scores showing a trend towards decreasing. In contrast, the High Practice group's 5FMQ scores increased significantly over time. In addition, there was a significant positive correlation between MT Practice Time and changes in 5FMQ over time. Thus, despite the decrease of in-class MT instruction in MMFT relative to MBSR, and the predeployment context with stressors increasing over time (Bolton et al., 2001; Lieberman et al., 2005; MacDonald et al., 1998; Maguen et al., 2008; Morgan et al., 2006), these results suggest that greater time spent engaging in MT exercises outside of class corresponded to increases in mindfulness.

We also assessed whether MMFT can help participants modulate perceptions of stress. On the one hand, based on MBSR studies in which mindfulness scores mediated stress and symptom reduction and improvements in well-being (Carmody & Baer, 2008; Shapiro et al., 2008), we predicted that changes in 5FMQ scores might similarly correspond to reductions in perceived stress in MMFT

participants. On the other hand, civilian MT courses are taught in the context of relatively constant stressors over time, while the predeployment period is a context with stressors increasing over time (Bolton et al., 2001; Lieberman et al., 2005; MacDonald et al., 1998; Maguen et al., 2008; Morgan et al., 2006). Therefore, the net effect of MT on perceived stress in the context of increasing stressors was uncertain. While the data do not show a significant relationship between MT Practice Time and perceived stress, changes in 5FMQ scores, which are related to MT Practice Time, were significantly related to changes in PSS scores. Given these relationships, future research is warranted to further explore the relationships between mindfulness practice, mindfulness, and perceived stress levels. These findings suggest that not only is MT feasible in the predeployment context, but that mindfulness practice may help service members who engage in greater amounts of practice modulate stress and improve their functioning despite increased stressors during this interval.

Since more MT practice is related to greater increases in mindfulness (Carmody & Baer, 2008), we wanted to assess which factors correspond with the likelihood of engaging in practice. Interestingly, none of the demographic factors we examined—age, military rank, education level, and marital status—were related to Practice Time. While some Marines anecdotally reported that they had been willing to try MMFT exercises because their old coping skills had proven insufficient when they returned home from previous deployments, prior deployments were also unrelated to Practice Time. T1 POS scores did significantly correspond to Practice Time. This result may suggest that Practice Time relies in part on participants' willingness to have a more engaged, flexible, novelty-producing, and novelty-seeking personal outlook. Finally, the survey composite score, which measured participants' views at T2 about MMFT and its potential benefits, corresponded to Practice Time at nearly significant levels. This finding emphasizes the critical importance of motivating participants to practice regularly and highlights the value of adapting MT to make it accessible and useful for specific settings.

The encouraging results of this case report should be considered in light of several limitations. First, this analysis relies heavily on a self-reported measure of mindfulness. While self-reported measures of mindfulness are the most practicable proxy in research on this topic to date, mindfulness as a construct remains underspecified in terms of its cognitive, affective, and neural mechanisms of action. Moreover, mindfulness might be interacting with other mechanisms that promote stress resilience. Indeed, we did not directly examine outcome measures of resilience, and these data do not measure the intervention's effect on resilience over time. Thus, future research

about MMFT's efficacy would benefit from gathering data longitudinally on measures that index resilience.

Second, our cohort was a convenience sample, consisting of a detachment that agreed to receive training, due to limited access to military cohorts during the predeployment window. Limited access also resulted in a modest sample size; having to exclude some participants for incomplete data may have affected the results. Moreover, while we were able to test a comparison group from the same parent unit, there were several important differences between the groups. The groups were tested at different bases, with different testing atmospheres. The groups also had different predeployment training schedules; thus, testing occurred at different time-points relative to each group's predeployment training. In addition, the groups received different predeployment training, with the MMFT group participating in additional training, such as live-tissue emergency medical training, which the MMFT participants stated was more strenuous than the comparison group's predeployment training. Furthermore, we were unable to control for prior combat deployments between the two groups, with the comparison group having relatively fewer Marines with prior deployment history. This limited the extent to which the comparison group served as an adequate control. Finally, they were not an active control, which prevented comparison on Practice Time and thus the outcome relationships of interest.

Nonetheless, given these promising albeit preliminary results, as well as other research reporting MMFT's beneficial effects for preserving or improving working memory capacity, preserving positive affect, and reducing negative affect (Jha et al., 2010), future studies of MMFT are warranted. Future studies should be explicitly designed to examine the complex interrelationships between practice time, mindfulness, perceived stress, and other variables that may influence all or some of these factors with MT. Future studies should also include a larger number of participants (as in a Phase II trial) and be conducted using a group-randomized design, with an active control training. Finally, future studies should more explicitly measure the training's effects on group effectiveness.

Another motivation for conducting more studies of MMFT is to understand better the utility of MT in high-stress contexts. While most studies of MT have focused on demonstrating training-related improvements when situational demands are stable, our findings suggest that MT may provide prophylaxis in high-stress and increasingly demanding contexts. All of our participants experienced the stress-intensifying context of predeployment training, but only those who engaged in MMFT exercises showed an increase in self-reported mindfulness, which was further associated with reductions in perceived stress.

Future research will help determine whether MMFT reduces the likelihood of stress-related psychological dysfunction and physical ailments and whether it can provide greater resources for adaptive functioning during deployment to the morally ambiguous and emotionally challenging counterinsurgency environment.

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This project was funded by the John W. Kluge Foundation and the Dept. of Defense (Grant # W81XWH-08-1-0715 to APJ and EAS). We would like to thank Pauline Baniqued for assistance with data collection, Kaye Coker for support regarding intervention delivery, and Tussi and John Kluge for their generous support on this project. We also wish to thank J.S. and J.D. for their invaluable role in allowing this project to take place.

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Received: January 21, 2010

Accepted: August 13, 2010

Available online 18 January 2011