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Regular Attendance of In-Person and Virtual World Mindfulness Meditation Classes and Attention Deficit and Hyperactivity Symptoms: Does Practice Time Make a Difference?

by Valerie Rice, Paul J Schroeder, and Gary Boykin

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Regular Attendance of In-Person and Virtual World Mindfulness Meditation Classes and Attention Deficit and Hyperactivity Symptoms: Does Practice Time Make a Difference?

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14. ABSTRACT Mindfulness meditation training (MMT) is effective at reducing symptoms of attention deficit and hyperactivity (ADHD) symptoms in military personnel. However, those who attend more of the scheduled classes and spend greater time practicing mindfulness on their own may experience greater symptom reduction. In the current study, 179 US military active-duty service members and veterans completed the attention deficit and hyperactivity current symptoms scale before and after being placed into an in-person (23–27 in-class h) or virtual world MMT (15 in-class h) group or a wait-list control group. Data from volunteers who attended four or more classes (of nine total classes) was analyzed. In-class time and self-reported personal practice time were also assessed and analyzed. For both MMT groups, significant reductions were found in overall ADHD symptoms, as well as in hyperactivity-impulsivity and inattention subscales (ps < 0.001). No significant changes in symptoms were found for the control group. Neither in-class time or self-reported personal practice time was significantly correlated with pre/post improvements (ps > 0.05). The results demonstrate that in-person and virtual world remote delivery of MMT are equally effective at reducing ADHD symptoms, and that in-class time and personal practice time did not impact symptom outcomes. As virtual world training required fewer training hours to achieve the same symptom reductions, it may be the preferred program for ADHD symptomatology.					
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1. Introduction

Attention deficit and hyperactivity disorder (ADHD) is a psychological and behavioral condition in which a person exhibits a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with daily life ([APA] American Psychiatric Association 2013). As of 2020, the global prevalence of adult ADHD was estimated to be between 139.84 million and 366.33 million (or 2.58% and 6.76%) (Song et al. 2021). Although it is typically diagnosed in childhood, ADHD can cause difficulties into adulthood, interfering with work and relationships (APA 2013) and increasing risk for workplace accidents and/or injury (Brunkhost-Kanaan et al. 2021). Additionally, there is strong evidence that adult ADHD is associated with increased risk for substance use disorder (Crunelle et al. 2018).

While ADHD is not a disqualifying condition for US military service, there is concern that service members with ADHD may be at greater risk for encountering significant personal challenges as compared with their counterparts without ADHD. Available data indicates that ADHD symptoms are relatively common among Army personnel, accounting for 7%–9% of a 21,449 population surveyed (Kok et al. 2019). Studies have shown positive correlations between symptoms of ADHD and symptoms of depression, anxiety, posttraumatic stress disorder (PTSD), poor cognitive performance (Hanson et al. 2012), comorbid substance use disorder, and use of legal stimulants (caffeine beverages and pills) (Cipollone et al. 2020). Thus, there is an imperative to ensure that warfighters (and others that work in high-stress occupations) maintain and self-regulate attention.

Stigma toward mental health issues may deter some from seeking support for difficulties with attention; however, complementary wellness approaches are a viable alternative. Mindfulness meditation is a Buddhist-inspired approach to enhancing well-being using yoga, focused breath, and other techniques to focus attention and initiate insight. Numerous programs offer training in mindfulness (Marchand et al. 2021), but the most well-known is mindfulness-based stress reduction (MBSR; Kabat-Zinn 2003). A key feature of MBSR is enhancing present-moment awareness.

Research on the benefits of mindfulness training on awareness, focus-of-attention, and working memory follows. Morrison and Jha (2015) posited that mindfulness meditation training (MMT) enhances participants' ability to focus their attention by reducing or eliminating distracting thoughts. Reducing or eliminating irrelevant content held in working memory increases one's capacity to encode, process, and store ongoing information. Support for this theory comes from studies showing post-training improvements on working memory span tasks (Jha et al. 2010),

measures of sustained attention (Jha et al. 2015; Rice and Liu 2017), and marksmanship (Nassif et al. 2021). These findings are important because ADHD is associated with impairments in working memory (Lundervold et al. 2019). At the same time, some research raises doubts about the impact of MMT on working memory processes (e.g., Baranski 2021) and the effectiveness of training programs to increase working memory capacity (Melby-Lervåg et al. 2016).

Despite skepticism, the majority of studies on MMT indicate that mindfulness training is effective at reducing inattention and symptoms of hyperactivity/impulsivity in children and adults with ADHD diagnoses (Cairncross and Miller 2020). In a meta-analytic review of studies on mindfulness interventions for ADHD, Cairncross and Miller (2020) reported an overall moderate effect size of $d = -0.66$, with larger effect sizes found for studies with adult participants as compared with children, indicating that adult participants may receive greater benefits. Active-duty military and veterans have been shown to reduce ADHD symptoms following MMT training (Rice et al. 2018). Another published study and meta-analyses report demonstrated improvements in executive functioning following mindfulness training for adults with ADHD (Poissant et al. 2019, 2020). These findings are noteworthy because other efforts aimed at helping individuals with ADHD manage symptoms were less successful (Rapport et al. 2013). While the available evidence supports that participation in mindfulness-based interventions reduce symptoms of adult ADHD, additional research is needed to fill lingering gaps in knowledge.

One outstanding research gap is the impact of training delivery on outcomes. Prior to the COVID crisis, mindfulness training programs were usually offered in person. However, advances in communication technologies have enabled classes to be taught online. This is helpful for circumventing roadblocks to attendance. Evidence favoring of one delivery modality over another is mixed. For example, Rice et al. (2019) found that in-person delivery of training was more effective at reducing participants weekly self-reports of pain and sleepiness, and increasing energy, as compared with remote delivery. One explanation for this finding is that participants who attend classes in person may form stronger interpersonal bonds with their instructor and classmates (Rice and Schroeder 2021), despite equivalent learning with their remote counterparts. It remains an open question as to whether remote training is as effective as in-person delivery of mindfulness training, especially for other outcome measures (Winter et al. 2022).

Another unresolved gap is the contribution of time, via class attendance and outside class practice time, on outcomes. MBSR training comprise 8 weeks of classes offered once a week for approximately 2.5 h of class time, with an all-day (7-h) silent retreat between weeks 6 and 7. This presents practical challenges for

participants with busy and/or erratic schedules, such as military service members. In addition, it poses a challenge to participants with ADHD who struggle with organizational skills, such as time management (LaCount et al. 2018). Some evidence suggests that greater time spent outside of class practicing concepts (Jha et al. 2010, 2017) and regular class attendance (Amaro et al. 2014; Tamagawa et al. 2015; Roos et al. 2019) are associated with improved outcomes following mindfulness training. However, there are inconsistencies in reporting of these variables. There is a need for additional studies on the impact of practice time and class attendance on outcomes of ADHD symptoms, especially for active-duty military.

In the present study, we examined the effects of an MMT program delivered in person and remotely via the virtual world of Second Life, with US military active-duty service members and veterans self-reported symptoms of ADHD. Specifically, we investigated outcomes in participants that attended four or more classes during the training program of eight classes and one all-day silent retreat. Based on outcomes from prior studies (i.e., Rice et al. 2018), we hypothesized that MMT would be effective at reducing symptoms of ADHD, regardless of delivery modality. We also assessed participants number of hours in class, number of outside class practice hours, and the combination of the two. As dose/response outcome studies are few and have had mixed results, we hypothesized there would be no significant difference.

2. Method

2.1 Participants

Two hundred and fifty active-duty and veteran US military participants were recruited via posted flyers and recruitment events on a US military base and the surrounding community for a larger study on resilience. The primary goal of the current study was to examine the impact of MMT on the changes scores of self-reported symptoms of ADHD among those that attended four or more classes (“good attenders”). This yielded 179 valid cases (71.60% of the original sample). Study procedures were reviewed and approved by an Institutional Review Board and all participants signed informed consent forms. Participants did not have a specific disorder or illness and were healthy. They were not compensated for their participation.

2.2 Procedure

The analyses reported here were collected prior to and after completing the MMT program. Figure 1 displays the recruitment and assignment process. Briefly, after signing an informed consent, participants were non-randomly assigned (convenience sample) to an in-person meditation training (IPMT) group, a virtual world meditation training (VWMT) group, or a wait-listed control group (CG). The assignment was a limited timeframe, availability convenience sample, filling and starting one group and then another. Participants did not know which group they would be attending until they completed their pretesting. Participants in the VWMT group completed training online in the virtual world Second Life (Secondlife.com). Both IPMT and VWMT groups met once a week for 8 weeks including an all-day silent retreat. Classes consisted of yoga, breath work, and other techniques to increase present moment awareness of physical sensations, thoughts, and emotions, and guided discussions. The VWMT classes were 1.5 h versus IPMT classes of 2–2.5 h. The “all day training” was 3 h for the VWMT group versus 7 h for the IPMT group. These times were based on pre-study assessments of the amount of time Soldiers and veterans were willing to participate in a single session of online training. All training was based on MBSR training with participants completing the same homework assignments and receiving the same handouts. Participants assigned to the CG did not participate in stress-related training sessions. All participants were active-duty service members or military veterans.

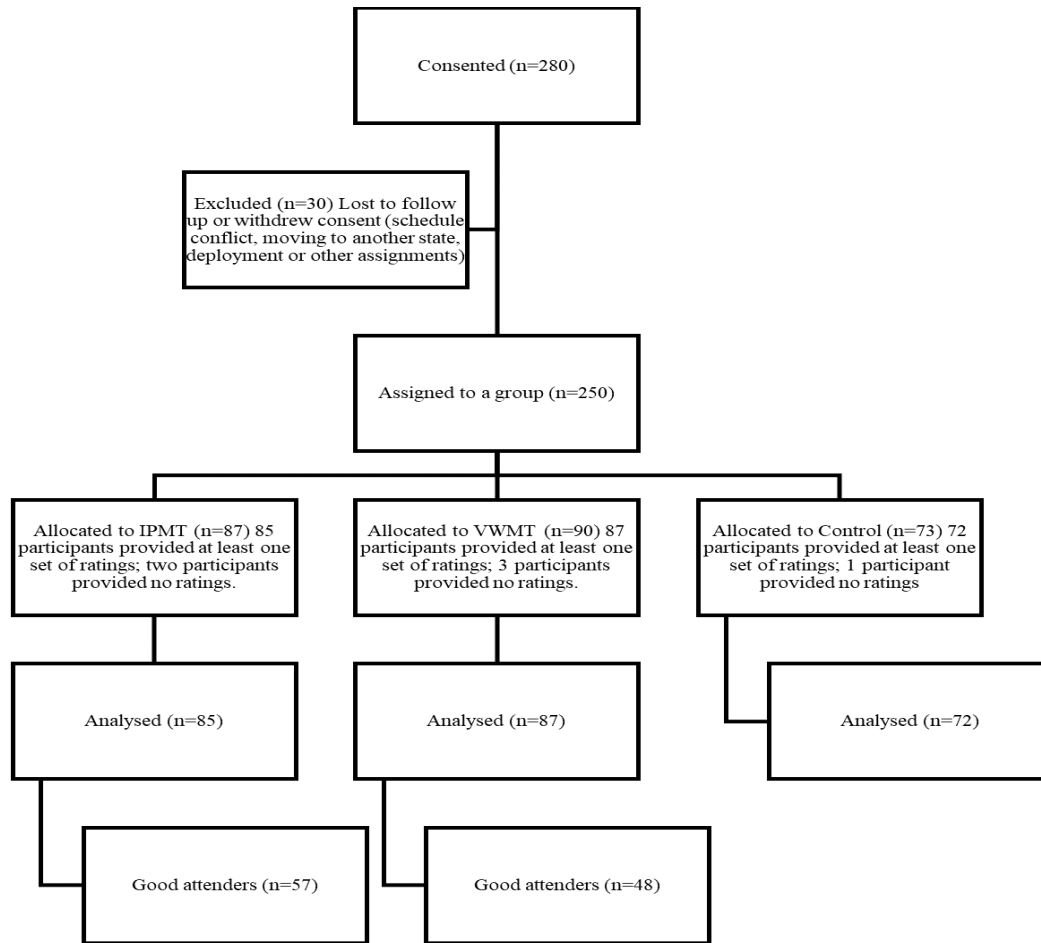


Fig. 1 Flow chart of the study participants' enrollment and group assignment

2.3 Materials

2.3.1 Demographics

Participants completed a demographics survey prior to beginning active participation in MMT. Information included age, gender, race, marital status, educational level, time-in-service (time on active duty), and active-duty versus veteran status.

2.3.2 ADHD Current Symptoms Scale (ADHD CSS)

The ADHD CSS (Barkley and Murphy 1998) is an 18-item self-rating checklist on the existence, prevalence, and impact of ADHD symptoms. It is based on the diagnostic criteria of the DSM-IV (APA 1994). The questionnaire uses a Likert scale that ranges from 0 (“Never”) to 3 (“Very often”). Only responses with a 2 (“Often”) or 3 (“Very often”) are counted. The total score of the scale indicates the

severity of the ADHD symptoms. The ADHD CSS consists of a total score, an inattention subscale, and a hyperactivity subscale.

2.3.3 Self-Report Practice Time Surveys

Participants filled out a personal practice time self-report survey at the start of each class. The survey was based on the previous week and included the amount of time spent practicing mindfulness meditation techniques. While the techniques used were also reported, those data are not reported in this report.

2.4 Data Analysis

Data for the ADHD CSS were analyzed using analysis of variance (ANOVA). Participants that attended four or more classes were included in the analysis. All data were analyzed using SPSS Data Software.

Thresholds of at least 10% and 20% improvement from pre- to post-training test results were judged by medical staff as representing clinically meaningful changes of small and moderate magnitudes, respectively. Chi-square tests were used to determine whether differences in proportions of subjects meeting these thresholds in the three study groups were statistically significant.

Secondary analyses of the relationships between class attendance and practice time with change scores on the ADHD overall scores, and hyperactivity-impulsivity and inattention subscales were conducted using Pearson Product correlation coefficients. Change scores from baseline were computed with the formula: post-training score – pre-training score. Percent change scores from baseline were computed with the formula: (post-training score – pre-training score)/pre-training score × 100. Frequency counts and chi-square analyses were used to assess differences among groups in numbers of subjects who achieved meaningful improvements. Because no minimally important differences have been published for the ADHD scale and subscales, we used $\geq 20\%$ versus $< 20\%$ improvement from baseline, and also $\geq 10\%$ versus $< 10\%$ improvement from baseline to represent two possible thresholds for representing minimally important improvements. These were based on medical staff recommendations as to clinical relevance. Data was blinded to the statistician, as to group assignment.

3. Results

3.1 Demographics

Participants average self-reported age was 48.04 years (SD = 2.04 years). The majority of participants self-identified as male (52.36%), Caucasian (28.34%), married (29.63%), and having completed some college or had an associate's degree (33.68%). Most were serving or had served in the Army (34.34%) (versus other military services) and were veterans (68%) versus active duty (32%) with an average time in service of 15.40 years (SD = 0.52 years)

3.2 Analysis of Total Score on the ADHD CSS

Average total scores on the ADHD CSS for those attending four or more classes are presented in Fig. 2. Analyses of the total reported symptoms revealed a significant group \times time interaction, $F(2,144) = 8.14, p < 0.001$. Significant differences were found in the number of symptoms reported before and after training, resulting in a significant main effect of time, $F(1,144) = 40.35, p < 0.001$. Participants in the IPMT and VWMT groups reported significantly fewer symptoms post-training as compared with pre-training, $ps < 0.001$. No significant difference was found in the reported symptoms of the control group, $p = 0.72$. Also, significant between-group differences were found in the self-reported symptoms of the three groups, $F(2,197) = 3.24, p = 0.04$. Self-reported symptoms were not significantly different between the IPMT and VWMT groups, $p = 0.90$; however, participants in the IPMT and VWMT groups reported significantly more symptoms at pre-training, as compared with the CG, $ps = 0.001$.

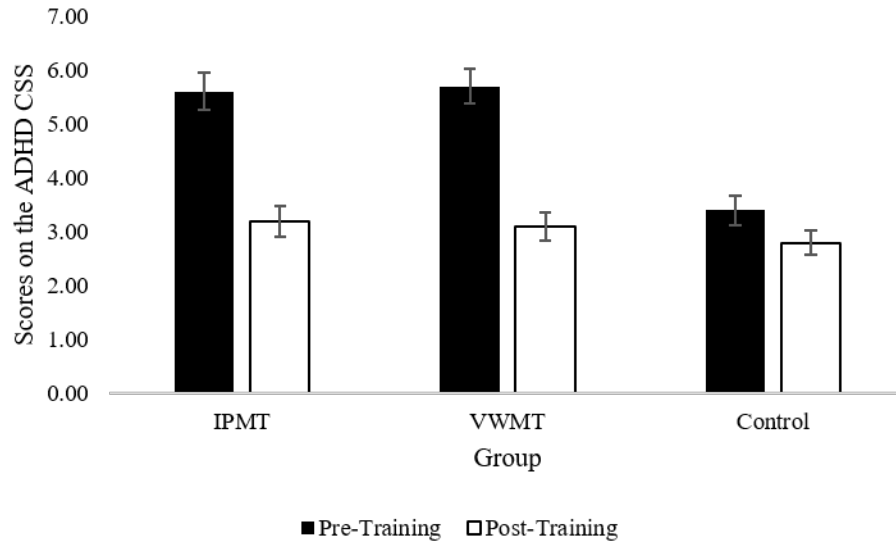


Fig. 2 Average total scores on the ADHD CSS (error bars = standard errors) for good attenders

Clinical Results. Among those attending four or more classes, the proportions of participants with $\geq 20\%$ improvements (lower ADHD total scale) post-training compared to pre-training were not significantly different among the study groups: 68.4% in the IPMT group; 68.6% in the VWMT group; 44.4% in the CG, $\chi^2(2) = 4.84$, $p = 0.09$. The proportions of participants with $\geq 10\%$ improvements were significantly different among the study groups: 78.9% in the IPMT group; 74.3% in the VWMT group; 44.4% in the CG, $\chi^2(2) = 9.61$, $p = 0.008$.

3.3 Analysis of Scores on the Hyperactivity-Impulsivity Subscale of the ADHD CSS

Average scores on the hyperactivity-impulsivity subscale of the ADHD CSS for those attending four or more classes are presented in Fig. 3. Analyses of the reported symptoms on the hyperactivity-impulsivity subscale revealed a significant group \times time interaction, $F(2,145) = 7.13$, $p = 0.001$. Significant differences were found in the number of symptoms reported before and after training, resulting in a significant main effect of time, $F(1,145) = 45.56$, $p < 0.001$. Participants in the IPMT and VWMT groups reported fewer symptoms post-training as compared with pre-training, $ps < 0.001$. No significant difference was found reported in the pre/post symptoms of the control group, $p = 0.36$. No significant between-group differences were found in the self-reported symptoms the three groups, $F(2,171) = 1.25$, $p = 0.29$. Although self-reported symptoms were not significantly different between the IPMT and VWMT groups, $p = 0.60$, participants in the IPMT and

VWMT groups reported significantly more symptoms at pre-training as compared with the CG, $p = 0.003$ and 0.001 , respectively.

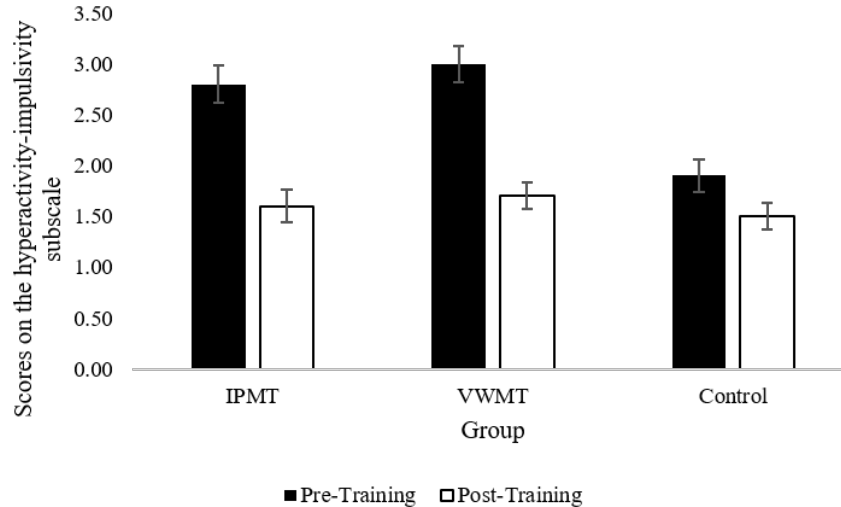


Fig. 3 Average scores on the hyperactivity-impulsivity subscale of the ADHD CSS (error bars = standard errors) for good attenders

Clinical Results. Among the regular attenders, the proportions of participants with $\geq 20\%$ improvement (lower hyperactivity-impulsivity subscale) post-training compared to pre-training were significantly different among the study groups: 75.0% in the IPMT group; 79.40% in the VWMT group; 44.40% in the CG, $\chi^2(2) = 9.74$, $p = 0.008$.

Likewise, the proportions of participants with $\geq 10\%$ improvement were significantly different among the study groups: 80.60% in the IPMT group; 82.40% in the VWMT group; 48.10% in the CG, $\chi^2(2) = 10.80$, $p = 0.005$.

3.4 Analysis of Scores on the Inattention Subscale of the ADHD CSS

Average scores on the inattention subscale of the ADHD CSS for all participants are presented in Fig. 4. Analyses of the reported symptoms on the inattention subscale revealed a significant group \times time interaction, $F(2,138) = 6.47$, $p = 0.002$. Significant differences were found in the number of symptoms reported before and after training, resulting in a significant main effect of time, $F(1,138) = 25.39$, $p < 0.001$. Participants in the IPMT and VWMT groups reported fewer symptoms post-training as compared with pre-training, $ps < 0.001$. No significant difference was found in the reported symptoms of the CG, $p = 0.99$. Also, no significant between-group differences were found in the self-reported symptoms of the three groups,

$F(2,175) = 1.81, P = 0.17$. Although self-reported symptoms were not significantly different between the IPMT and VWMT groups, $p = 0.88$, participants in the IPMT and VWMT groups reported significantly more symptoms at pre-training as compared with the control group, $p = 0.002$ and 0.004 , respectively.

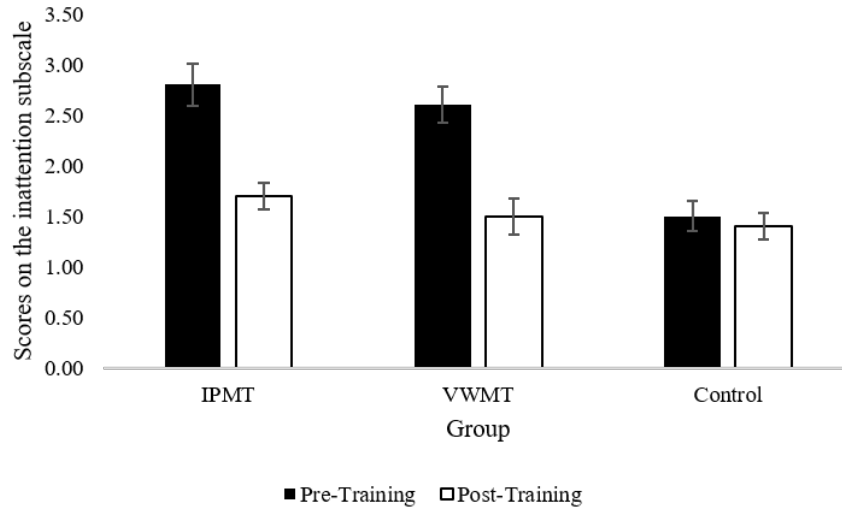


Fig. 4 Average scores on the inattention subscale of the ADHD CSS (error bars = standard errors) for good attenders

Clinical Results. Among the good attenders, the proportions of participants with $\geq 20\%$ improvement (lower inattention subscale) post-training compared to pre-training were not significantly different among the study groups: 64.70% in the IPMT group; 67.90% in the VWMT group; 45.80% in the CG, $\chi^2(2) = 3.05, p = 0.22$.

Likewise, the proportions of participants with $\geq 10\%$ improvement were not significantly different among the study groups: 70.60% in the IPMT group; 71.40% in the VWMT group; 45.80% in the CG, $\chi^2(2) = 4.75, p = 0.09$.

3.5 Analysis of Relationships of Class Attendance and Practice Time with ADHD Symptoms

There were no statistically significant relationships between class attendance or practice time with pre/post-training change scores for the ADHD total scale for good attenders from either group receiving training (correlation coefficients ranged from -0.04 to 0.09 ($p_s \geq 0.39$) (Table 1).

Table 1 Bivariate correlations between total change scores on the ADHD CSS, the sum of the total number of classes and total class time, total practice time (h), total class time (h), and number of classes or sessions attended

Measure	1	2	3	4	5
(1) ADHD CSS total scale change score	...	0.08	0.09	-0.04	0.05
(2) Total class + total class time (h)	0.98 ^a	0.44 ^a	0.38 ^a
(3) Total practice time (h)	0.26 ^a	0.23 ^b
(4) Total class time (h)	0.78 ^a
(5) No. classes or sessions attended

^a p < 0.05

^b p < 0.01

Likewise, there were no statistically significant relationships between class attendance or practice time with pre- to post-training change scores for the hyperactivity-impulsivity subscale (Table 2). Correlation coefficients ranged from <-0.01 to 0.06 (ps ≥ 0.60).

Table 2 Bivariate correlations between change scores on the hyperactivity-impulsivity subscale of the ADHD CSS, the sum of the total number of classes and total class time, total practice time (h), total class time (h), and number of classes or sessions attended

Measure	1	2	3	4	5
(1) ADHD CSS hyperactivity-impulsivity subscale change score	...	0.05	0.06	-0.01	-0.00
(2) Total class + total class time (h)	0.98 ^a	0.44 ^a	0.38 ^a
(3) Total practice time (h)	0.26 ^a	0.23 ^a
(4) Total class time (h)	0.78 ^a
(5) No. classes or sessions attended

^a p < 0.05

^b p < 0.01

Similar to the first two analyses, there were no statistically significant relationships between class attendance or practice time with pre- to post-training change scores for the inattention subscale in the two groups receiving MBSR training (Table 3). Correlation coefficients ranged from -0.06 to 0.11 (ps ≥ 0.31).

Table 3 Bivariate correlations between total change scores on the inattention subscale of the ADHD CSS, the sum of the total number of classes and total class time, total practice time (h), total class time (h), and number of classes or sessions attended

Measure	1	2	3	4	5
(1) ADHD CSS inattention subscale change score	...	0.09	0.11	-0.06	0.82
(2) Total class + total class time (h)	0.98 ^a	0.44 ^a	0.38 ^a
(3) Total practice time (h)	0.26 ^a	0.2 ^b
(4) Total class time (h)	0.78 ^a
(5) No. classes or sessions attended

^a p < 0.05

^b p < 0.01

4. Discussion

The primary hypothesis was supported and was consistent with outcomes reported by Rice et al. (2018), that is, IPMT and VWMT were effective at reducing overall symptoms of ADHD, symptoms of hyperactivity/impulsivity, and symptoms of inattention, while a wait list CG was not. These findings support research findings from two meta-analytic investigations, one focused on the effectiveness of mindfulness-based interventions identifying large effects in reducing ADHD core symptoms, and a second demonstrating improvements in ADHD symptoms, as well as negative effect and cognition (Xue et al. 2019; Poissant et al. 2020, respectively). Moreover, these results also corroborate an earlier feasibility study with adults finding reductions in ADHD self-reported symptoms, depression, and anxiety (Zylowska et al. 2008).

Clinically, pre- to post-training reductions in symptoms were seen for the overall ADHD symptoms and for hyperactivity-impulsivity subscale, but not for the inattentive subscale. This latter finding on inattention did not substantiate Cairncross and Miller's (2020) meta-analysis, in which mindfulness training was reported to have a greater impact on inattention as compared with hyperactivity/impulsivity. It is possible that methodological differences in how ADHD symptoms were assessed or discerning features of the training may account for the discrepant outcomes between studies. Also, prior empirical research found that participation in mindfulness training was effective at boosting Soldiers' attention (Jha et al. 2015), and our study also showed improvements of symptoms on overall attention deficit symptoms, as well as those involving hyperactivity/impulsivity. These results broaden current findings by demonstrating clinical relevance of MMT in reducing symptoms of overall ADHD and hyperactivity/impulsivity, but not the subscale of inattention. This points to the necessity for research exploration of the effectiveness of mindfulness interventions with ADHD subtypes and inclusion of clinical relevance assessments.

No support was found for a dose-response relationship in terms of number of class hours or self-reported practice time with symptom reduction. These findings counter those reported by Jha and colleagues (2017), who found greater home practice time was correlated with scores on a sustained attention task. They also counter findings of Goldberg and colleagues (2020), who reported greater practice time being associated with higher quality practice and the reduction of psychological symptoms. No studies were found that directly assessed a dose-response effect with ADHD symptoms.

Both in-person and remote delivery of mindfulness training were effective at reducing symptoms of ADHD. This finding supports and extends outcomes from prior research that found that both delivery modalities were effective at reducing other psychological symptoms (Rice et al. 2018, 2019), as well as studies that leveraged virtual worlds to deliver mindfulness training (e.g., Hoch et al. 2012; Yuen et al. 2013). That virtual worlds are an effective alternative to in-person delivery of mindfulness training demonstrates its potential for deployment overseas, in far-forward scenarios, and in remote locations. Moreover, it opens the doors for new therapeutic, scientific, and commercial applications. Future research could explore if virtual worlds are as (or more) effective than other online-based training approaches, such as video conferencing or mobile applications, as this could provide valuable insight into both the foundations of online learning and the benefits of mindfulness training. The finding that the in-person group (involving 23–27 in-class h) and the VWMT group (15 in-class h) equally reduced ADHD symptoms also contributes new information on mindfulness and attentional difficulties. Future research focusing on the necessary time commitment to achieve significant results would be of great interest to the military and to businesses who want to attain the greatest benefits per unit of training time.

Four other conditions in this study make it unique. First, it shows that in-person and virtual world training achieved the same reductions in ADHD-related symptoms among healthy adults with self-reported ADHD symptoms. This increases outreach possibilities by qualified (yet meager in terms of availability) MBSR teachers to remote locations. Second, the results demonstrate the effective utility of mindfulness training to reduce ADHD symptoms among healthy adults, without a diagnosis of ADHD, and improve their attention, concentration, and positive functioning at home and work. Third, prior results demonstrated greater improvements with in-person MMT in reducing participants' pain and sleepiness, and increasing energy, as compared with remote delivery. In this study, both in-person and remote delivery methods yielded similar reductions in ADHD symptoms. Future studies may benefit from focusing on the types of ailments and symptoms that improve according to particular delivery methods. Fourth, the participants were US military active duty and veterans, thus demonstrating the efficacy of mindfulness training for reducing symptoms associated with ADHD among military personnel and veterans. ADHD symptoms include difficulties with the following:

- Concentrating
- Being quiet
- Being still

- Impulsivity
- Interrupting
- Having little to no discernment of danger
- Paying attention
- Being easily distracted
- Making careless mistakes
- Losing things or being forgetful
- Sticking with, and organizing, assignments

Reduction of these symptoms would enhance military service members' ability to direct and maintain attention and self-regulate impulses, which are essential for optimal performance.

Time management, organization, prioritization, an increased attention span, and coping with stress can all be improved through the reduction of such symptoms. Sharpening these abilities is critical because service members are expected to perform in a variety of situations, each of which might have different requirements. For example, one day could be fast-paced and action-oriented and the next might entail long durations of inactivity. Frequent and sudden shifts in routines are cognitively and emotionally jarring, even for experienced personnel. The need for resources to optimize readiness for change cannot be overstated. The results of the current study indicate that attending a mindfulness meditation class will likely improve symptoms associated with ADHD, potentially improving individual productivity and achievement of the military mission as a whole.

5. Conclusions

MBSR is an effective template for reducing symptoms of ADHD among active-duty and veteran US military service members. Both in-person and virtual world training, offered in real time, are equally effective in reducing pre/post ADHD symptoms. There does not appear to be an increase in effectiveness with increased meditation personal practice time or hours of class time. Mindfulness interventions with normal, healthy active-duty and veteran personnel improves symptoms of attention, concentration, distractibility, and impulsivity. Two recommendations include 1) offering MMT training to military and veteran service members, 2) offering MMT to civilian Department of Defense personnel, and 3) conducting further research to determine the generalizability of the results to other healthy populations.

There were several limitations in the current study. First, group assignment was not randomized, but was a convenience sample. Second, pre-training scores on the ADHD CSS were higher for the IPMT and VWMT groups as compared with the control groups, possibly giving the MMT groups greater opportunity for improvement. Third, the samples comprised active-duty and veteran US military service members, which limits generalizations to other populations.

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List of Symbols, Abbreviations, and Acronyms

ADHD	attention deficit and hyperactivity disorder
ANOVA	analysis of variance
APA	American Psychiatric Association
ARL	Army Research Laboratory
CG	control group
CSS	current symptoms scale
DEVCOM	US Army Combat Capabilities Development Command
IPMT	in-person meditation training
MBSR	mindfulness-based stress reduction
MMT	mindfulness meditation training
PTSD	posttraumatic stress disorder
SD	standard deviation
VWMT	virtual world meditation training

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