Participation in Outdoor Recreation Program Predicts Improved Psychosocial Well-Being Among Veterans With Post-Traumatic Stress Disorder: A Pilot Study

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ABSTRACT Purpose: Evaluate the effectiveness of a 2-day, 3-night outdoor recreation intervention involving fly-fishing in reducing the psychological concomitants of stress among 74 veterans (M = 47.27, SD = 14.55 years) with post-traumatic stress disorder (PTSD). Methods: Participants completed repeated assessments of attentiveness, mood, depression, anxiety, and somatic stress across 3 time periods, corresponding to 2 weeks before the trip (baseline), the last day of the trip, and a 6-week follow-up. Assessments of perceptual stress, PTSD symptoms, and sleep quality were also administered during the baseline and follow-up periods. Results: Acute effects were observed for improvements in attentiveness and positive mood states, coupled with significant and sustained reductions in negative mood states, anxiety, depression, and somatic symptoms of stress. Comparisons between the baseline and follow-up periods revealed significant improvements in sleep quality and reductions in perceptual stress and PTSD symptoms. Conclusions: The current findings suggest that combat veterans with PTSD may benefit from participation in group-based outdoor recreation as a means to improve psychosocial well-being.

INTRODUCTION

A debilitating condition, post-traumatic stress disorder (PTSD), afflicts an estimated 7.7 million American adults, according to the National Institutes of Health.[1] Amid this population are those who acquired the disorder in combat. Current estimates from the U.S. Department of Veterans Affairs state that PTSD affects about 30% of Vietnam veterans, 10% of Gulf War veterans, 11% of Afghanistan veterans, and 20% of veterans returning from Iraq.[1] PTSD is characterized by symptoms resulting from traumatic event experience. These symptoms include recurring and distressing memories of trauma, hyperarousal, and avoidance of stimuli that trigger traumatic memories.[2] Due in part to this clustering of symptoms, PTSD has high comorbidities with anxiety disorders, major depressive disorder, and sleep disturbances.[3] Consequently, those with PTSD have been known to engage in avoidant coping strategies, such as alcohol and drug abuse, to ameliorate the symptomatology associated with the condition.[4]

In addition to the symptoms and pathologies noted above, the effects of PTSD run deep below the surface at the physiological level, resulting from the wear and tear of a heightened stress system. The detrimental effects of stress on health are well documented.[5,6] Chronic activation of the sympathetic nervous system can lead to high blood pressure and proinflammatory responses predictive of cardiovascular and immune dysfunction.[7,8] Both prospective and archival research has found that veterans with PTSD are more likely to report health problems than those without PTSD.[9–11] A 50-year prospective study suggests that combat-induced trauma predicts mortality rates by the age of 65.[12] Moreover, a recent prospective study of approximately 2,000 initially healthy combat veterans revealed PTSD to predict coronary heart disease morbidity and mortality.[13]

Common PTSD treatments run the full gamut of pharmacologic interventions, cognitive behavioral therapies, exposure therapy, and supportive psychotherapy.[14,15] Psychotropic medication has been used to address PTSD symptoms as well as comorbid disorders, such as depression and anxiety. The most frequently administered drugs include antidepressants, anxiolytics, sedative hypnotics, and in some cases antipsychotics.[16,17] Despite the demonstrated efficacies of these various therapeutic approaches, a substantive proportion of patients with PTSD remain symptomatic following treatment.

Therapies designed to address stress symptoms at the psychosocial level may incur benefit by improving quality of life among patients with PTSD. Alternative therapies, such as outdoor therapeutic recreation, have promising implications for use among populations with PTSD, but have not been adequately examined within this target population. However, leisure and recreation activities have been found to reduce self-reported levels of stress and contribute to both physical and mental health in a variety of settings and among a host of demographic samples.[18–20] Moreover, recent cross-sectional evidence has found significant associations between tendencies to engage in leisure activities and a variety of psychological and physical well-being assessments.[21] Individuals reporting higher levels of leisure activity participation were found to display lower depression, negative affect (NA), resting blood pressure, daily cortisol production, waist circumference,

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body mass index, and higher levels of positive affect (PA). Indeed, experimental evidence has found spending time in natural environmental settings to increase PA, attentional capacity, and ability to reflect on a life problem.[22]

Theoretical models designed to interpret the health-promoting effects of leisure activity participation have proposed attention restoration and leisure-related social support as potential mechanisms that may facilitate a shift toward improved psychosocial well-being among participants.[23–25] Attention restoration theory posits that spending time in natural environments confer restorative effects on cognitive abilities.[24] The theory has garnered support through research indicating that natural environmental stimuli modestly elicit involuntary attention mechanisms, thereby enabling directed attention mechanisms an opportunity to replenish, whereas urban environmental stimuli exerts a comparatively intense impact upon attention resources and as such are not restorative.[24] An experimental intervention has provided supportive evidence, revealing an hour-long stroll through an arboretum to predict significant improvements on directed attention tasks relative to an hour-long walk through an urban area.[26]

Another theoretical orientation in the therapeutic recreation literature concerns the stress-buffering influence of leisure-related social support on health, suggesting that the presence of social support fostered via leisure activities enhances coping resources for daily stress.[23] A longstanding history in health psychology research has focused attention on the salubrious effects of social support.[27] Individuals in integrated social networks display lower disease morbidity and mortality rates relative to the socially isolated.[28] Leisure activities often include a social companionship element serving as a critical component for predicting improved physical and mental health outcomes.[23] Leisure-engendered social support may moderate the effects of stress on health by working as an instrumental agent in reducing depression and physical illness symptoms.[25]

The focus of the current research is to evaluate the effectiveness of a group-based outdoor recreation program involving fly-fishing in reducing the psychological concomitants of stress among a sample of veterans with PTSD. The primary hypothesis under investigation is that the fly-fishing retreat will predict acute elevations in attentiveness and sustained improvements in psychosocial well-being and sleep quality, in addition to reductions in PTSD symptomatology. An exploratory ancillary hypothesis concerns the strength and direction of association between particular dependent variables, whereby reductions in PTSD symptoms will predict improvements in sleep quality.

METHODS

Participants

The participants included 74 veterans (69 men, 5 women; M = 47.27, SD = 14.55 years; range: 22–64 years) who participated in one of the 19 fly-fishing retreats for veterans with PTSD at the Rivers of Recovery (ROR) residential facility, located off the Green River in northern Utah, which took place in summer to early fall of 2009 and 2010. ROR is a nonprofit organization dedicated to improving quality of life for veterans with disabilities through fly-fishing excursions along the Green River, a body of water stocked with rainbow and brown trout; the activity of fly-fishing was selected by the ROR organization because the sport has been regarded to induce a calm alertness in a pristine natural environment that may enhance the ability to focus and reduce perceptual stress levels. Inclusionary criteria for participation involved being a veteran who has served in a foreign country with a confirmed diagnosis of PTSD (n = 73) or exhibiting a clinically relevant score on the PTSD check list, military version (PCL-M; n = 1).[29] Dual diagnosis of PTSD/major depressive disorder (n = 43) or PTSD/traumatic brain injury (n = 23) was permitted as a result of the high comorbidity rates of these psychopathologies. Exclusionary criteria included dual diagnosis with an Axis I disorder from the Diagnostic and Statistical Manual IV other than PTSD or major depressive disorder.

Ninety six individuals met all the above stated criteria and were enrolled as participants in this study. Six (6%) of these individuals dropped out/withdrew from the study following baseline assessment and before participation in the fly-fishing excursion, whereas another 16 (17%) participants from the initially enrolled sample dropped out/withdrew from the study after participating in the fly-fishing excursion and before the follow-up assessment. Independent samples t-tests confirmed that the 22 participants who dropped out/withdrew from the study following the baseline assessment or fly-fishing excursion did not differ from the 74 participants who completed the study through the follow-up assessment in terms of age or total baseline score from the PCL-M ($p > 0.3$).

Recruitment for the fly-fishing retreats was through private referral and fliers distributed at recreation therapy offices in Veteran Administration hospitals. All participants signed an informed consent document before participating in this study, which received approval from the Institutional Review Board at the University of Southern Maine. Participants also completed a health and demographics questionnaire designed for the purposes of this study, containing items concerning age, education, ethnicity, marital status, military service, and pharmacologic treatments to date. Sample characteristics are featured in Table I. The sample was predominantly Caucasian (81%), with 23% of the sample reporting no more than a high school education, 63% having an associate's degree, and the remaining 14% of the sample reporting a bachelor's degree or higher. Most of the veterans served in the U.S. Army (68%), with the remaining having served in the Marines (15%), Navy (9%) or U.S. Army National Guard (8%). The median length of military service was 4 years (range = 1–38 years), with 7 veterans still employed by the military at the time of research participation.

TABLE I. Demographic Data, Military Service, and Pharmocologic Treatments (n = 74)

Variables	% (Frequency)	M (SD)
Age in Years		47.27 (14.55)
Ethnicity		
American Indian	7 (5)	
Asian/Pacific Islander	4 (3)	
Caucasian	81 (60)	
Hispanic	5 (4)	
Multiracial	3 (2)	
Education		
High School Diploma	23 (17)	
Associate's Degree	63 (47)	
Bachelor's Degree	11 (8)	
Master's Degree	3 (2)	
Marital Status		
Single	20% (15)	
Married	70 (52)	
Divorced	10 (7)	
Military Service		
U.S. Army	68 (50)	
Marines	15 (11)	
Navy	9 (7)	
U.S. Army National Guard	8 (6)	
Veteran Era		
Gulf War	12 (9)	
OEF/OIF	46 (34)	
Vietnam	42 (31)	
Pharmacologic Treatments[a]		
Antidepressants	60 (44)	
Antipsychotics	10 (7)	
Anxiolytics	19 (14)	
Opiates	23 (17)	
Sedative Hypnotics	23 (17)	

[a]35/74 (47%) of the participants were taking a combination of pharmacologic treatments.

Measures and Procedures

This study represents a repeated measures longitudinal assessment of 19 separate 3 night, 2 day fly-fishing excursions offered through the ROR program on the Green River in northern Utah. Each participant served as his/her own control. The fly-fishing excursions took place on Thursdays to Sundays in August and September of 2009 (5 trips) and June to October of 2010 (14 trips). The excursions varied in terms of number of participants from 2 to 7 veterans (M = 4, SD = 1.6 veterans). Participants underwent repeated psychosocial assessments of mood, depression, anxiety, and somatic symptoms of stress, across 3 time periods, corresponding to 2 weeks before the fly-fishing excursion (baseline), the last day of the fly-fishing retreat, and a 6-week follow-up assessment. Additional psychosocial assessments of perceptual stress, PTSD symptoms, and sleep quality were administered during the baseline and follow-up periods. All psychosocial assessments were administered online via use of Survey Monkey.

Intervention

The fly-fishing excursions involved a small group of veterans sharing lodging accommodations in a 3-bedroom house for 3 nights and spending a total of 16 hours fly-fishing from drift boats on the Green River across 2 days (e.g., arriving on a Thursday evening, fly-fishing on Friday and Saturday, and returning home on Sunday morning). Participants were provided the opportunity to learn the art of fly-fishing by trained specialists, connect with others who have experienced similar life challenges, and enjoy the setting of a pristine natural environment. Transportation to the ROR residential facility was provided by the program. Upon arrival, participants were given time to settle into their lodging before dinner. After dinner, participants were introduced to the ROR staff and fly-fishing guides and discussed the trip activities and fishing schedule. The subsequent 2 days included the following itinerary: breakfast, 4 hours of morning fishing, lunch along the river, 4 hours of afternoon fishing, social hour at the residential facility, dinner, and postdinner games/entertainment. Participants were provided transportation home following breakfast on the morning after the second day of fly-fishing.

Dependent Variables: Psychosocial Assessments

The PCL-M was used to assess degree of PTSD symptoms via diagnostic criteria of hyperarousal, re-experiencing, and avoidance behaviors within the past month. Participants rated the 17 PCL-M self-report items on a scale ranging from 1 = not at all to 5 = extremely. This inventory has demonstrated good psychometric properties,[29] with previous research supporting a global cutoff score of "50" or greater to represent clinically relevant PTSD symptomatology.[29] A study of 117 OEF/OIF combat veterans using the PCL-M to index PTSD symptoms reported a high internal consistency (α = 0.97).[30]

Psychological distress was measured using the Brief Symptom Inventory-18 (BSI), an 18-item Likert-type scale designed to measure the severity of anxiety, depression, and somatic symptoms of stress in the past week.[31] Possible scores for the total scale range from 0 to 72, with higher values indicative of more severe psychological distress. This inventory has demonstrated adequate internal consistencies (0.71–0.89) and test–retest reliabilities (0.68–0.82).[32]

Mood was assessed with the Positive Affect and Negative Affect Schedule (PANAS), a 60-item Likert-type scale in which participants respond to various emotive adjectives in reference to the past week on a 5-point scale ranging from 1 = very slightly to not at all to 5 = extremely.[33] The PANAS is a widely used inventory with demonstrated convergent validities relative to other standardized mood inventories and adequate internal consistencies across subscales (α = 0.75–0.93 amid a sample of 328 adults).[33]

The Perceived Stress Scale (PSS), a 10 item self-report inventory, was used to assess how unpredictable, uncontrollable, and overloaded respondents found their lives in the past month.[34] Participants rated each item on a 5-point scale ranging from 0 = never to 4 = very often. The PSS has demonstrated adequate internal consistencies in across a variety of large samples (n > 1,000 each), with α ranging from 0.78 to 0.91.[35]

Participants completed the Pittsburgh Sleep Quality Inventory (PSQI), a 19-item self-report questionnaire designed to measure 7 components of sleep quality in the past month, the sum of which yields one global score.[36] Respondents rated each item from this inventory on a 4-point scale, with "0" = "not in the past month" and "3" = "'three or more times a week." Potential global score values range from 0 to 21, with lower scores indicating better sleep quality. This inventory has been found to display adequate internal consistencies across four clinical samples ($\alpha = 0.80$) with demonstrated convergent and discriminant validities.[37]

Analytic Strategy

All statistical analyses were conducted using the Statistical Package for the Social Sciences, version 19.0, with alpha levels set to 0.05 for delineation of significant effects.[38] To test whether the fly-fishing intervention predicted significant reductions in psychological distress coupled with improvements in mood, three separate multivariate analyses of variance (MANOVA's) on repeated measures were run on all three time periods, with Bonferroni post hoc procedures to control for Type 1 Error. The first MANOVA evaluated significant differences over time in total scale scores for the BSI, along with the corresponding subscale scores of depression, anxiety, and somatic stress. The second MANOVA evaluated significant differences in PANAS scales of NA, guilt, hostility, fear, and sadness, whereas the third MANOVA evaluated significant changes in PANAS scales of PA, serenity, self-assuredness, attentiveness, and joviality. These three sets of analyses were predicted to reveal that baseline psychosocial assessments would differ significantly from last day and follow-up assessments, revealing significant and sustained reductions in BSI scores and negative mood states, accompanied by improvements in positive mood states. Paired sample *t*-tests were used to assess significant reductions in perceptual stress, PTSD symptoms, and global sleep quality between baseline and follow-up periods.

Pearson product moment correlations tested if reductions in PTSD scores predicted improvements in sleep quality using residualized change scores in accord with recommendations.[39] Residualized change scores for the PTSD and sleep quality variables were created by regressing postfishing trip scores on their respective baseline values, resulting in standardized residual values from these regression equations that represent change over time after controlling for variation because of baseline values. Residualized change in global PCL-M scores was correlated with residualized change in global PSQI scores pertaining to change from baseline to the follow-up period.

RESULTS

Psychosocial Effects

BSI Analyses

A repeated measures MANOVA on the BSI total score and subscales was significant, $F(6,68) = 32.08$, $p < 0.001$, ${}_p\eta^2 = 0.79$. All underlying univariate statistics were significant: BSI total, $F(2,146) = 79.25$, $p < 0.001$, ${}_p\eta^2 = 0.52$; BSI somatic stress, $F(2,146) = 25.48$, $p < 0.001$, ${}_p\eta^2 = 0.26$; BSI depression, $F(2,146) = 87.79$, $p < 0.001$, ${}_p\eta^2 = 0.55$; and BSI anxiety, $F(2,146) = 63.85$, $p < 0.001$, ${}_p\eta^2 = 0.47$. Bonferroni post hoc analyses revealed the fly-fishing excursion to be linked to significant and sustained reductions on all measures, comparing baseline levels to last day and follow-up assessments ($p < 0.001$).

Positive Affect and Negative Affect Schedule

A second repeated measures MANOVA on the PANAS scales of NA, guilt, hostility, fear, and sadness was significant, $F(10,64) = 17.4$, $p < 0.001$, ${}_p\eta^2 = 0.73$. The univariate analyses corresponding to these scales were significant: NA, $F(2,146) = 62.84$, $p < 0.001$, ${}_p\eta^2 = 0.46$; guilt, $F(2,146) = 33.12$, $p < 0.001$, ${}_p\eta^2 = 0.31$; hostility, $F(2,146) = 71.83$, $p < 0.001$, ${}_p\eta^2 = 0.50$; fear, $F(2,146) = 32.25$, $p < 0.001$, ${}_p\eta^2 = 0.31$; and sadness, $F(2,146) = 38.74$, $p < 0.001$, ${}_p\eta^2 = 0.35$. Bonferroni post hoc analyses revealed significant and sustained reductions on all measures from the last day of the fly-fishing excursion to the follow-up assessment relative to the baseline period ($p < 0.001$).

The third repeated measures MANOVA on the PANAS scales of PA, serenity, self-assuredness, and joviality was significant, $F(10,64) = 22.21$, $p < 0.001$, ${}_p\eta^2 = 0.78$, in addition to all underlying univariate statistics: PA, $F(2,146) = 98.84$, $p < 0.001$, ${}_p\eta^2 = 0.58$; serenity, $F(2,146) = 76.63$, $p < 0.001$, ${}_p\eta^2 = 0.51$; self-assuredness, $F(2,146) = 44.49$, $p < 0.001$, ${}_p\eta^2 = 0.38$; attentiveness, $F(2,146) = 38.91$, $p < 0.001$, ${}_p\eta^2 = 0.35$; and joviality, $F(2,146) = 125.73$, $p < 0.001$, ${}_p\eta^2 = 0.63$. Bonferroni post hoc analyses indicated significant acute effects for increases on all measures for the last day of the fly-fishing excursion relative to the baseline period ($p < 0.001$), with the exception of the serenity subscale, which also evidenced sustained increases when comparing the baseline to the follow-up period ($p < 0.05$). Table II summarizes the findings pertaining to the BSI and PANAS inventories.

PTSD Check List, Military Version, Perceived Stress Scale, and Pittsburgh Sleep Quality Inventory

A paired sample *t*-test evaluated change in overall PCL-M scores between the baseline and follow-up periods, depicting a significant reduction, $t(73) = 6.62$, $p < 0.001$. A set of exploratory paired sample *t*-tests examined changes in PCL-M subscale scores between baseline and follow-up, indicating significant effects for reductions on all 3 subscales: hyperarousal, $t(73) = 6.56$, $p < 0.001$; avoidance, $t(73) = 5.88$, $p < 0.001$; and re-experiencing, $t(73) = 5.28$, $p < 0.001$. Additional paired sample *t*-tests evaluated hypothesized reductions in perceptual stress and improvements in sleep quality between baseline and follow-up periods, indicating significant effects for both scales: PSS, $t(73) = 5.56$, $p < 0.001$; and PSQI, $t(73) = 2.23$, $p < 0.001$. Descriptive statistics pertaining to these analyses are featured in Table II.

TABLE II. Descriptive Statistics for Psychosocial Measures

Variables	Baseline	Last Day	Follow-Up
BSI Total Scale	28.14 (13.48)[a]	11.39 (10.32)	18.38 (12.41)
BSI Somatic Stress	7.05 (5.04)[a]	3.9 (4.06)	4.9 (4.24)
BSI Depression	10.32 (5.48)[a]	2.92 (3.72)	5.99 (4.69)
BSI Anxiety	10.76 (5.48)[a]	4.56 (4.21)	7.49 (5.2)
NA	26.59 (7.87)[a]	16.3 (6.84)	22.49 (7.41)
Guilt	15.31 (6.09)[a]	9.64 (4.47)	12.61 (5.98)
Hostility	16.64 (5.33)[a]	9.29 (3.89)	13.94 (5.06)
Fear	14.73 (5.47)[a]	9.99 (4.27)	12.54 (4.95)
Sadness	13.34 (4.8)[a]	8.26 (3.59)	11.07 (4.32)
PA	25.61 (7.24)[b]	36.36 (7.66)	26.92 (7.72)
Serenity	6.86 (2.3)[c]	11.12 (3.01)	7.77 (2.73)
Self-Assuredness	15.07 (4.9)[b]	19.55 (4.95)	15.66 (4.75)
Attentiveness	11.16 (3.18)[b]	13.93 (2.9)	11.39 (3.1)
Joviality	18.03 (6.44)[b]	29.35 (7.27)	19.43 (6.98)
PCL-M Total	59.43 (13.55)[a]		49.63 (15.14)
PCL-M Re-experiencing	16.7 (5.07)[a]		14.06 (5.23)
PCL-M Avoidance	23.73 (6.09)[a]		19.91 (6.43)
PCL-M Hyperarousal	19.0 (4.28)[a]		15.65 (4.67)
PSS	23.42 (6.64)[a]		19.46 (7.11)
PSQI	13.12 (3.55)[a]		11.62 (3.88)

Descriptive statistics are presented by *M* (SD). $n = 74$. [a]Baseline > other assessment(s), $p < 0.001$. [b]Baseline < Last Day, $p < 0.001$. [c]Baseline < Last Day and Follow-up, $p < 0.05$.

Ancillary Psychosocial Analysis

A correlational analysis was performed on residualized change scores for the PCL-M and PSQI total scores to determine whether reductions in PTSD symptoms predicted improvements in overall sleep quality. In support of this exploratory hypothesis, a significant correlation on residualized change from baseline to follow-up was observed between these scales, $r = 0.657$, $p < 0.001$, suggesting that sleep quality may improve (reductions in PSQI score) along with decrements in PTSD symptoms.

DISCUSSION

The purpose of this study was to evaluate the effectiveness of a fly-fishing program in reducing the psychological concomitants of stress among a sample of 74 veterans with PTSD. The results suggest that outdoor recreation is linked to significant improvements in psychosocial well-being. Acute effects indicated significant elevations in attentiveness and positive mood states, accompanied by significant and sustained reductions in symptoms of depression, anxiety, and somatic stress, in addition to negative mood states. Moreover, the psychosocial benefits of the outdoor recreation appear to endure up to the 6-week follow-up assessment. Follow-up analyses revealed increases in sleep quality and significant reductions in perceptual stress and PTSD symptoms. An additional ancillary analysis revealed that reductions in PTSD symptoms served as a driving force that predicted improvements in sleep quality.

The findings regarding outdoor recreation as a medium for improving psychosocial well-being are consistent with other studies investigating the use of leisure coping in response to stressful events. Leisure-coping strategies have been argued to distract individuals from trauma and help them to reconnect with a prior sense of self-established before a traumatic experience.[40] These processes of distraction and reconnection maybe instrumental properties of outdoor recreation that foster improvements in psychosocial wellness. The findings from this study resonate with theoretical orientations that natural environmental settings elicit a restorative impact upon individuals, such as attention restoration theory.[24,26]

The outdoor recreation of fly-fishing employed in this study involves activities that subtly engage participant attention on a new skill in a pristine natural environment. The acute increases in attentiveness and serenity in this study suggests that participation in the outdoor recreation under investigation may induce a state of calm alertness among the participants. The attentional focus achieved through participation in this program may distract participants from intrusive thoughts of combat-related trauma, one of the key symptoms of PTSD for this population; likewise, the calming environmental setting may serve as a grounding medium that enables participants to reclaim a sense of self unaffected by the combat experience.

The significant reduction in overall PTSD symptoms observed in this study is encouraging. Moreover, exploratory analyses also revealed significant reductions in all three subscales of hyperarousal, avoidance, and repeated thoughts of trauma symptoms from baseline to the follow-up period, findings that parallel the simultaneous reductions in perceptual stress levels amid this sample. Previous research has examined the ability of leisure coping to buffer the effect of stress on mental illness, indicating that social support, generated through therapeutic recreation, moderated the relationship between

stress and mental health.[25] Combat-induced trauma is a context specific experience that may distance veterans from their loved ones. A fundamental component of the ROR program is a dynamic social support system emerging in each of the fly-fishing retreats. As such, social support remains an inextricable component of the veteran experience under study and may explain a significant proportion of the favorable changes in psychosocial well-being observed here, including the reductions in PTSD symptoms. In fact, a longitudinal investigation on the benefits of leisure activity among a group of participants from "high stress" occupations of emergency response and law enforcement revealed that although relaxing leisure activities predicted reductions in perceptual stress, "social leisure" and "outdoor recreation" activities were uniquely predictive of improvements in mental health.[41]

Increasing access to group-based outdoor therapeutic recreation interventions maybe effective in reducing symptoms of mental illness. Alongside the significant reduction in PTSD symptoms, results from this study indicate significant reductions in symptoms of depression and anxiety following outdoor recreation, providing data that complement other corelational studies which have revealed an inverse association between depressive symptoms and leisure activities.[21,25]

In addition to reductions in symptoms of depression and anxiety, this study found a wealth of acute improvements in mood profiles among participants, including significant increases in state measures of attentiveness, serenity, self-assuredness, joviality, and PA. Results also revealed significant decreases in feelings of guilt, hostility, fear, sadness, and NA, reductions that sustained to the follow-up assessment. On the whole, the findings pertaining to improvements in mood profiles are consistent with other reports linking leisure activities to increases in PA, decreases in NA, or both.[21,42,43]

The results found throughout this study are consistent with research regarding the beneficial effect of recreation and leisure on various assessment levels of stress and well-being. The significant and sustained reductions in somatic symptoms of stress (e.g., faintness, nausea, chest pain, etc) observed in this study are in line with a variety of cross-sectional evidence linking leisure activity participation to measures of physical wellness.[21,44] Reductions in perceptual stress and reports of improved sleep quality found among participants in the ROR program were expected in light of research indicating the efficacy of leisure in regards to improvements in health and quality of life. Leisure and recreation has been positively associated with a number of health promoting psychosocial factors, including sleep quality.[21] Participants who engaged in leisure activities with greater frequency were more likely to report higher sleep efficiency and sleep quality. The findings suggest that participation in peer-based outdoor recreation may promote improvements in sleep quality amid a sample of combat veterans with PTSD, a target population known to display poor sleep quality.[45] Finally, an ancillary exploratory analysis in this study suggests that outdoor recreation-induced reductions in PTSD symptoms may predict improvements in sleep quality over time, preliminary evidence that may merit subsequent examination amid a more substantive study.

The current investigation represents a pilot study program evaluation of an outdoor recreation intervention to reduce the psychological concomitants of stress among a group of veterans with PTSD. As such, the findings from this study should be considered preliminary and interpreted with caution because of numerous limitations, such as the use of a small, self-selected sample without a control group. The current findings merit replication in a larger sample of veterans, perhaps as part of a randomized clinical trial. Future studies should aim to delineate what qualities of the outdoor recreation intervention predict the salubrious changes in psychosocial outcome. For example, an assessment of state social support could be administered as a covariate to determine if the effects of the intervention are significant after controlling for the variance pertaining to social support. Despite the limitations discussed, this study suggests that group-based outdoor recreation interventions may incur psychosocial benefits amid combat veterans with PTSD. The significant improvements in attentiveness and positive mood states, coupled with significant reductions in PTSD symptoms and associated qualities such as stress, depression, anxiety, and negative mood states, have potential implications for PTSD treatment as well as further examination of outdoor recreation as a therapeutic tool.

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