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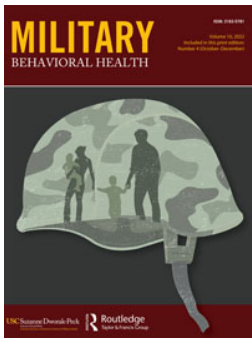
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RESEARCH ARTICLE



## Pilot Study: The Effects of a Mountain Wilderness Experience on Combat Veteran Psychosocial Wellness

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### ABSTRACT

The purpose of this quasi-experimental pilot study was to evaluate the efficacy of a 3.5 day outdoor wilderness program (Huts for Vets, HFV) for reducing psychological distress, PTSD symptoms, and improving positive mood states. It was hypothesized that participation in the HFV program would predict improvements in psychosocial well-being in addition to reductions in PTSD symptomatology relative to a waiting-list control group. Participants included 51 adult veterans diagnosed with PTSD and/or some other combat-related disability ( $M_{\text{age}} = 36.8$ ,  $SD = 8.19$ ). The experimental group ( $n=32$ ) participated in the HFV program, which included hiking and group discussions. Data collection *via* psychosocial scale administration took place two weeks prior to the HFV trip, on the last day of the trip, and at a 6 week follow up. Participants in the control group ( $n=19$ ) underwent the psychosocial assessments on the same schedule, however, they did not participate in the outdoor program. Results indicated significant and sustained reductions in depression, anxiety, somatic stress, negative affect, and PTSD symptoms among program participants, alongside acute improvements in positive moods, relative to the control group. The current findings suggest that therapeutic recreation offers promising benefits as a complementary intervention for combat veterans.

### KEYWORDS

Leisure time and activity;  
posttraumatic stress disorder;  
recreational therapy; depression;  
affect

Post-traumatic stress disorder (PTSD) is a debilitating condition with an estimated lifetime prevalence of 6.8% Americans (Kessler et al., 2005). Combat veterans make up a large portion of this prevalence, claiming an estimated 30% of Vietnam veterans, 12% of Gulf War veterans, and 11-20% of veterans returning from Afghanistan and Iraq (National Center for PTSD, 2018). Although advancements in military gear and drone technology have lowered soldier injuries, the psychological turmoil associated with PTSD has lasting effects for combat veterans. PTSD symptoms stem from experiencing a traumatic event, such as combat, severe injuries, and violent acts. Symptoms of PTSD include four categories (reexperiencing, hyper-arousal, avoidance, and negative thoughts/feelings), that persist for at least one month (Torres, 2020). Reexperiencing symptoms include nightmares, hallucinations or flashbacks, whereas hyper-arousal includes difficulty falling asleep, heightened startle response, and hyper-vigilance. Avoidance symptoms includes pulling away from loved ones, avoiding people and/or places that could be reminders of the trauma, and reduced participation in normal daily activities. Finally, negative thoughts

and feelings include distorted beliefs about self and others, in addition to the tendency to experience a high volume of negative affect, including sadness, guilt, shame, anger, and hostility. Among combat veterans, the following co-morbidities with PTSD are common: traumatic brain injury, major depressive disorder, anxiety disorder, sleep disorders, substance misuse disorder, and cardiovascular disease/metabolic syndrome (e.g., Britvic et al., 2015; Gilbert et al., 2015; O'Toole et al., 2010; Yehuda, 2018). Collectively, the disease burden of PTSD among combat veterans is significant, leading to poor health outcomes and quality of life.

Current PTSD treatments focus on symptom management and include exposure therapy, cognitive behavioral therapy (CBT), and pharmacotherapy. Due to the comorbid nature of PTSD with anxiety and depression, antidepressants are one of the most common drugs administered for pharmacologic treatment (National Institutes of Mental Health, 2020). Although the efficacy of the current treatment therapies for PTSD are widely supported in literature, a considerable amount of patients may remain symptomatic

despite treatment efforts (e.g., Kitchiner et al., 2019), thereby suggesting a need to explore complementary therapies. The goal of more holistic approaches to treating veterans with PTSD is not only to assist in symptom management and enhancement of quality of life, but also to help veterans develop healthy lifestyle behaviors; these behaviors may include recreational activities, establishment of social support networks, and increased ability to cope with stress (Charney & Marx, 2012). Recent literature has demonstrated substantial support for outdoor environmental leisure programs producing positive impacts on veterans with PTSD, both in terms of symptom management, improved mood, and reductions in anxiety, depression, and stress (Bettmann et al., 2021; Greer & Vin-Raviv, 2019; Walker et al., 2020).

Theories such as leisure engendered social support and attention restoration theory (ART) explain how therapeutic recreation programs can be helpful for veterans suffering with PTSD (Coleman & Iso-Ahola, 1993; Kaplan, 1995). Leisure-engendered social support is believed to buffer the effects of life stressors on adverse health outcomes, such as lowering depression symptoms (e.g., Iso-Ahola & Park, 1996). ART posits that spending time in natural environments is inherently calming and, as such, replenishes our attentional reserves, whereas urban environments are comparatively taxing to our attentional reserves and, as such, are cognitively depleting (e.g., Hartig et al., 2003). A variety of experimental studies have demonstrated support for ART, with findings illustrating that spending time in natural environments improves mood while significantly enhancing performance on cognitive tasks when compared to urban environments (Berman et al., 2008; Berto, 2005; Mayer et al., 2009). Current literature supports that engaging in leisure activities, such as sports or other outdoor group activities, promotes a variety of positive health related outcomes: lowered anxiety and depression, enhanced coping with life stressors *via* leisure-engendered social support and cognitive reappraisal, enhanced self-efficacy, and distraction of negative thoughts while generating a sense of optimism (Caldwell, 2005).

Limitations of existing literature on the benefits of outdoor therapeutic recreation for promoting combat veteran wellness include small sample sizes, heavy reliance on qualitative assessments prone to anecdotal bias, and failure to include a control group (e.g., Davis-Berman et al., 2018; Walker et al., 2020). These limitations collectively constrain the generalizability of the research findings. The focus of the current pilot study is to evaluate the effectiveness of a

therapeutic recreation program aimed at improving quality of life amid veterans while addressing common methodological limitations. Huts for Vets (HFV) is a nonprofit organization that provides disabled veterans with a 3.5 day hiking and discussion program in the Colorado National Wilderness. The primary hypothesis under investigation is that the HFV program will predict significant and sustained reductions in PTSD, anxiety, and depression symptomatology, in addition to negative mood states, alongside significant increases in positive mood states, when compared to a waiting list control group.

## Method

### Participants

The participants for the current study included 51 veterans ( $M_{\text{age}} = 36.8$ ,  $SD = 8.19$ ; 75% male) who had applied to participate in a 3.5 day outdoor wilderness excursion offered through HFV, located in Aspen, CO. Of the 51 veterans, 32 were assigned to the experimental group that participated in the HFV program under study, whereas the remaining 19 participants were assigned to a waiting-list control group and were provided the opportunity to attend the HFV program after the completion of the current study. HFV is a nonprofit organization dedicated to helping veterans transition back into civilian life through provision of skills to enhance their physical, mental, and emotional health. Inclusionary criteria for participation in the current study was serving as a military veteran in a foreign country. The sample included 26 veterans with a confirmed diagnosis of PTSD, in addition to another seven veterans who displayed a clinically relevant score at or above '50' on the PTSD checklist, military version (Forbes et al., 2001). Of the sample with a confirmed diagnosis of PTSD, dual diagnoses with traumatic brain injury ( $n=9$ ) and major depressive disorder ( $n=6$ ) were evident. Participants predominately served in the U.S. Army and Marine Corps with tours in Iraq and Afghanistan.

Prior to participation in the current study, all participants completed an informed consent document. All procedures and documents for the current study was approved by an Institutional Review Board. Following completion of the informed consent document, participants completed a health and demographics questionnaire containing items pertaining to age, gender, ethnicity, marital status, and pharmacologic treatments. These sample characteristics are summarized in Table 1.

**Table 1.** Demographic data and pharmacologic treatments ( $n = 51$ ).

Variables	% (Freq)	M (SD)
Age in years		36.8 (8.19)
Gender		
Male	75% (38)	
Female	25% (13)	
Ethnicity		
American Indian	2% (1)	
Asian/Pacific Islander	2% (1)	
Biracial	2% (1)	
Hispanic	16% (8)	
Unspecified	13% (7)	
White	65% (33)	
Marital Status		
Single	25% (13)	
Married	47% (24)	
Divorced	28% (14)	
Pharmacologic Treatments		
Antidepressants	32% (16)	
Antipsychotics	2% (1)	
Anxiolytics	12% (6)	
Opiates	8% (4)	
Sedative-Hypnotics	14% (7)	

## Materials

PTSD symptomatology was assessed *via* the PTSD Check-List, Military Version (PCL-M), a 17 item self-report inventory designed to measure three prominent diagnostic domains of hyper-arousal, reexperiencing, and avoidance behaviors (Weathers et al., 1993). For each item on the PCL-M, a five point Likert scale was used, whereby participants rated the severity of their symptoms in the past month on a scale ranging from 1 = *Not at All* to 5 = *Extremely*. The PCL-M has demonstrated good psychometric properties in terms of test-retest reliabilities and internal consistencies (Jakupcak et al., 2007; Wilkins et al., 2011).

The Brief Symptom Inventory-18 (BSI-18) was used to measure symptoms of depression, anxiety, and somatic stress in the past week using a Likert scale of assessment ranging from 0 = *Not at All* to 4 = *Extremely* (Derogatis, 2000). Total scores for this inventory may range between 0-72, with higher values indicating more psychological distress. Adequate test-retest reliabilities (.74-.89) and internal consistencies (.74-.89) have been demonstrated for this inventory (Derogatis, 2001).

The Positive Affect and Negative Affect Scale (PANAS) was used to measure participant mood in the past week, a 60 item Likert scale whereby participants rate their mood as ranging from 1 = *Very Slightly or Not at All* to 5 = *Extremely* (Watson & Clark, 1994). This inventory was used to measure the primary variables of positive affect (10 items) and negative affect (10 items) in addition to seven subscales of interest: self-assuredness (6 items), joviality

(8 items), serenity (3 items), sadness (5 items), fear (6 items), hostility (6 items), and guilt (6 items). Convergent validities of the PANAS to other standardized mood inventories has been established, in addition to adequate internal consistencies across subscales ( $\alpha$ 's = .75-.93 amid a sample of 328 adults) (Watson & Clark, 1994).

## Procedures

The current study represents a 2 × 3 (Group X Time) quasi-experimental design on repeated measures with a waiting list control group. Fifty-one veterans completed the PCL-M, the BSI-18, and the PANAS on three occasions surrounding a 3.5 day hiking retreat in the Colorado National Wilderness: 2 wk prior to the trip (baseline), the last day of the trip, and at a 6 week follow-up. Of the 51 veterans, 19 participants were assigned to the waiting-list control group and completed their inventories on the same time line as those from the experimental group. The remaining 32 veterans represented the experimental group and participated in the outdoor excursion for the current study. Of the 26 veterans with a confirmed PTSD diagnosis, 7 were assigned to the control group, whereas the remaining 19 veterans with a confirmed PTSD diagnosis participated in the experimental group. All three inventories were administered for each assessment period in hard copy format. Participants from the waiting list control group were provided with postage paid return envelopes for each assessment, as were the experimental group at the baseline and follow-up assessments; completion of the last day assessment of the outdoor wilderness excursion took place at the retreat center base camp for the HFV program. ID codes were used on all data collection inventories to protect participant confidentiality. A compensation of \$15 was provided to participants for completion of each assessment.

## Intervention

HFV provides 3.5 day wilderness therapy retreats for veterans, in groups of 10-12 participants. Separate programs are offered for male and female veteran groups. The curriculum takes place on Thursdays-Sundays during the summer. Veterans are provided transportation to the HFV Roaring Fork Valley lodge, where they spend their first night. At dinnertime, staff and veterans become acquainted and discuss their service histories and difficulties readjusting to civilian life. On Friday morning, the veterans undergo a major hike from 8640 to 11300 feet

elevation in the Colorado National Forest, across 6.5 miles, to the hut cabin, where they will stay for two nights. For the remaining time at the hut (Friday afternoon through Sunday morning), veterans take part in short day hikes; formal group discussions based upon a collection of short readings concerning wilderness therapy, philosophy, and psychology; and “tool giving” experiential presentations offered by staff on trauma release, including information on the psychophysiology of the stress response. After breakfast and final discussions on Sunday morning, veterans hike back down to the HFV Roaring Fork Valley lodge and are provided transportation back home. The HFV staff include two licensed clinical psychologists who specialize in veteran populations, in addition to two wilderness guides. For more information about the program visit <https://hutsforvets.org/>.

### Analytic strategy

The sample size for the current study was determined based upon a power analysis from a previous investigation on outdoor therapeutic recreation for combat veterans that used the same assessments for PTSD, anxiety, and depression symptomatology (Vella et al., 2013). In particular, we opted to employ a 2:1 ratio of participant assignment to experimental and control groups, respectively. Based upon the PCL-M and BSI-18 baseline descriptive statistics and anticipating an average reduction on these measures of 10 points at the 6 week follow up assessment for the experimental group, we calculated a total sample size of 36 (24 experimental, 12 control) to achieve statistical power at .8 (Georgiev, 2020). Given an expected attrition rate between baseline and the follow up assessment of around 25% of the overall sample, we overenrolled to achieve an overall sample of 51 participants (32 experimental, 19 control), which was a fair assessment since the final sample at follow up was 41 participants (29 experimental, 12 control).

All analyses for the current study were conducted *via* the Statistical Package for the Social Sciences, v. 25 (IBM Corp, 2017). A series of  $2 \times 3$  (Group X Time) multivariate analyses of variance (MANOVAs) on repeated measures tested the hypotheses under investigation for the current study, with group entered as a between subjects factor (control vs experimental) and time as a within subjects factor (baseline, last day, and follow up). Bonferroni post hoc tests were used to control for Type I Error rate. Effect sizes were evaluated *via*  $\eta^2$ , whereby small effects range from .01-.09, medium effects from .1-.24, and large effects  $\geq .25$  (Vacha-Haase & Thompson, 2004). The first MANOVA tested the effects of HFV participation on

BSI-18 total scores and subscale values of anxiety, depression, and somatic stress. Two separate MANOVAs tested the influence of HFV participation on veteran mood, one focused on negative mood states of NA, sadness, fear, hostility, and guilt, whereas the other MANOVA evaluated positive mood states of PA, self-assuredness, joviality, and serenity. Finally, a last MANOVA tested the influence of HFV participation on PCL-M total scores, in addition to the subscale values of reexperiencing, hyper-arousal, and avoidance behaviors. It was predicted that HFV participation would lead to significant reductions in symptoms of depression, anxiety, and PTSD, in addition to reductions in negative moods states, while coupled with significant increases in positive mood states, when compared to the control group.

## Results

Table 2 displays means, standard deviations, and independent samples t-tests pertaining to baseline values of key variables under study as a function of treatment group. Non-significant differences were noted ( $p$ 's  $> .09$ ) for all variables with the exception of BSI anxiety, whereby experimental participants showed significantly elevated anxiety scores ( $M = 11.67$ ,  $SD = 6.5$ ) compared to control participants ( $M = 8.23$ ,  $SD = 4.74$ ),  $t(49) = 2.01$ ,  $p = .05$ . Seven participants from the control group and three participants from the experimental group dropped out of the study prior to the follow up period of assessment, resulting in a final sample size of 41 participants (29 experimental participants and 12 control participants). An attrition analysis indicated non-significant differences in baseline total PCL-M scores between completers ( $n = 41$ ;  $M = 51.2$ ,  $SD = 15.9$ ) and dropouts ( $n = 10$ ;  $M = 50.2$ ,  $SD = 21.1$ ),  $t(49) = .17$ ,  $p = .87$ .

### BSI-18 analyses

A  $2 \times 3$  (Group X Time) MANOVA on repeated measures revealed a significant main effect of time on BSI-18 total, anxiety, depression, and somatic stress scores,  $F(8,150) = 3.36$ ,  $p = .001$ ,  $\eta^2 = .15$ , whereas the main effect of group was non-significant,  $F(4,36) = .22$ ,  $p = .93$ ,  $\eta^2 = .02$ . Univariate analyses for time revealed significant main effects for BSI-18 total score,  $F(2,78) = 7.91$ ,  $p < .001$ ,  $\eta^2 = .17$ , in addition to depression,  $F(2,78) = 6.82$ ,  $p = .002$ ,  $\eta^2 = .15$  and anxiety,  $F(2,78) = 11.0$ ,  $p < .001$ ,  $\eta^2 = .22$ . Bonferroni post-hoc analyses of univariate main effects pertaining to time revealed that participants showed significant reductions in depression from baseline to the second



**Table 2.** Descriptive statistics for psychosocial variables at baseline by group.

Variable	Experimental	Control	t	df	p
	M (SD)	M (SD)			
BSI Depression	9.69 (6.68)	6.94 (4.59)	1.58	49	.12
BSI Anxiety	11.67 (6.5)	8.23 (4.74)	2.01	49	.05
BSI Somatic Stress	7.46 (5.73)	5.63 (3.85)	1.23	49	.23
BSI Total Score	28.63 (17.87)	20.84 (10.95)	1.71	49	.09
PCL Intrusive	15.03 (6.16)	12.32 (5.71)	1.56	49	.12
PCL Avoidance	21.96 (6.94)	19.00 (7.61)	1.42	49	.16
PCL Hyper-arousal	16.22 (4.76)	15.42 (5.01)	.57	49	.57
PCL Total Score	53.53 (16.82)	46.74 (16.34)	1.41	49	.17
Negative Affect	24.44 (9.91)	22.1 (8.36)	.88	49	.38
Hostility	13.97 (6.07)	14.68 (5.68)	.42	49	.68
Guilt	14.72 (6.94)	11.63 (5.44)	1.66	49	.10
Fear	14.05 (6.26)	11.21 (4.83)	1.7	49	.1
Sadness	12.91 (5.69)	11.37 (4.87)	.98	49	.33
Positive Affect	30.88 (7.3)	28.89 (7.07)	.95	49	.35
Joviality	22.22 (6.63)	22 (6.52)	.12	49	.91
Serenity	7.66 (2.71)	7.11 (2.85)	.69	49	.49
Self-Assuredness	18.38 (5.53)	16.95 (5.44)	.90	49	.37

Note.  $n=51$  (32 experimental, 19 control). BSI= Brief Symptom Inventory; PCL= PTSD Check List. Baseline analyses revealed experimental participants to display significantly elevated anxiety compared to control participants,  $p = .05$ .

assessment, whereas significant reductions in anxiety and BSI total scores were noted at the second and third assessments relative to baseline. See Table 3 for descriptive statistics pertaining to these analyses.

In addition to the significant MANOVA on time, the Group X Time interaction term was significant,  $F(8,150) = 2.2$ ,  $p = .03$ ,  $p\eta^2 = .11$ . Moreover, all underlying univariate interaction effects were significant: BSI-18 total,  $F(2,78) = 7.82$ ,  $p = .001$ ,  $p\eta^2 = .17$ ; anxiety,  $F(2,78) = 6.74$ ,  $p < .001$ ,  $p\eta^2 = .14$ ; depression,  $F(2,78) = 8.92$ ,  $p < .001$ ,  $p\eta^2 = .19$ ; and somatic stress,  $F(2,78) = 3.59$ ,  $p = .03$ ,  $p\eta^2 = .08$ . For each dependent variable, Bonferroni post hoc analyses revealed significant changes specific to the experimental group, demonstrating reductions in anxiety, depression, somatic stress, and BSI-18 total scores when comparing baseline to the last day of the HFV trip and the 6 week follow up ( $p$ 's  $< .01$ ). Figure 1 displays these Group X Time interactions for BSI-18 variables.

## PANAS analyses

### Negative mood states

The  $2 \times 3$  (Group X Time) MANOVA on repeated measures for PANAS negative mood states revealed significant effects for group,  $F(5,35) = 3.1$ ,  $p = .02$ ,  $p\eta^2 = .31$ , time,  $F(10,148) = 2.59$ ,  $p = .006$ ,  $p\eta^2 = .15$ , and the interaction term,  $F(10,148) = 1.87$ ,  $p = .05$ ,  $p\eta^2 = .11$ . Univariate analyses on group revealed a marginally significant effect specific to NA,  $F(1,39) = 3.81$ ,  $p = .06$ ,  $p\eta^2 = .09$ , whereby the experimental group displayed lower NA values ( $M=18.9$ ,  $SE = 1.3$ ) relative to the control group ( $M=23.5$ ,  $SE = 2$ ). Likewise, a significant univariate group effect was observed for hostile mood,  $F(1,39) = 7.71$ ,  $p = .008$ ,

$p\eta^2 = .17$ , whereby experimental participants demonstrated lower hostile mood ratings ( $M=10.7$ ,  $SE = .79$ ) relative to control participants ( $M=14.8$ ,  $SE = 1.2$ ). Significant time related effects were noted for all negative mood PANAS variables: NA,  $F(2,78) = 7.82$ ,  $p = .001$ ,  $p\eta^2 = .17$ ; sadness,  $F(2,78) = 6.65$ ,  $p = .002$ ,  $p\eta^2 = .15$ ; fear,  $F(2,78) = 3.63$ ,  $p = .03$ ,  $p\eta^2 = .09$ ; hostility,  $F(2,78) = 7.41$ ,  $p = .001$ ,  $p\eta^2 = .16$ ; and guilt,  $F(2,78) = 8.32$ ,  $p = .001$ ,  $p\eta^2 = .18$ . Bonferroni post hoc analyses revealed significant reductions in NA, sadness, and hostility, comparing baseline to the second assessment, whereas a sustained effect was observed for guilt, in which follow-up scores remained significantly lower than baseline (see Table 3).

Significant univariate interaction effects were noted across all PANAS negative affect mood states, except hostility ( $p = .12$ ): NA,  $F(2,78) = 4.35$ ,  $p = .016$ ,  $p\eta^2 = .1$ ; sadness,  $F(2,78) = 7.98$ ,  $p = .001$ ,  $p\eta^2 = .17$ ; fear,  $F(2,78) = 5.0$ ,  $p = .009$ ,  $p\eta^2 = .11$ ; and guilt,  $F(2,78) = 5.98$ ,  $p = .004$ ,  $p\eta^2 = .13$ . Figure 2 displays significant time related decreases in NA, sadness, fear, and guilt specific to experimental participants. Control participants displayed non-significant time related changes on these variables. Collectively, these findings reveal that the HFV experience elicits favorable reductions in negative mood states that were sustained at the 6-week follow-up.

### Positive mood states

A  $2 \times 3$  (Group X Time) MANOVA on repeated measures evaluated significant effects specific to PA, joviality, serenity, and self-assuredness. Significant multivariate effects were observed for group,  $F(4,36) = 2.76$ ,  $p = .042$ ,  $p\eta^2 = .24$ , time,  $F(8,150) = 2.36$ ,  $p = .02$ ,  $p\eta^2 = .11$ , and the group X time interaction,

**Table 3.** Univariate analysis descriptive statistics.

Variable	Time-related main effects		
	Baseline M (SE)	Last Day M (SE)	Follow-Up M (SE)
BSI Depression	8.16 (1.03) <sup>a</sup>	5.58 (.84)	6.9 (1.01)
BSI Anxiety	10.05 (1.04) <sup>b</sup>	6.79 (.86)	7.33 (1.01)
BSI Somatic Stress	6.4 (.87)	5.13 (.74)	4.91 (.77)
BSI Total Score	24.54 (2.71) <sup>b</sup>	17.51 (2.16)	19.13 (2.52)
PCL Intrusive	13.9 (1.00) <sup>b</sup>	12.08 (.83)	11.7 (.92)
PCL Avoidance	20.8 (1.24) <sup>b</sup>	17.37 (1.28)	17.81 (1.16)
PCL Hyper-arousal	15.96 (.78) <sup>b</sup>	13.75 (.88)	14.18 (.85)
PCL Total Score	50.63 (2.76) <sup>b</sup>	43.2 (2.75)	43.69 (2.64)
Negative Affect	23.9 (1.68) <sup>a</sup>	19.1 (1.12)	20.5 (1.27)
Hostility	14.3 (.98) <sup>a</sup>	11.3 (.68)	12.6 (.88)
Guilt	13.6 (1.16) <sup>b</sup>	10.8 (.87)	10.9 (.91)
Fear	13 (1.1)	11 (.75)	12.2 (.94)
Sad	12.2 (.96) <sup>a</sup>	9.8 (.67)	10.7 (.87)
Positive Affect	30.17 (1.19)	33.13 (1.4) <sup>c</sup>	29.83 (1.4)
Joviality	22.61 (1.15)	25.36 (1.22) <sup>d</sup>	22.09 (1.21)
Serenity	7.44 (.46)	9.0 (.46) <sup>d</sup>	7.52 (.46)
Self-Assuredness	17.97 (.89)	19.01 (.87)	17.49 (.84)
Group Main Effects			
	Control	Experimental	
Variable	M (SE)	M (SE)	
Negative Affect	23.5 (2.0)	18.9 (1.3) <sup>†</sup>	
Sadness	11.9 (1.3)	10 (.81)	
Fear	12.8 (1.4)	11.4 (.87)	
Hostility	14.8 (1.2)	10.7 (.79)**	
Guilt	12.6 (1.5)	10.9 (.96)	
Positive Affect	28.1 (1.9)	34.1 (1.2)**	
Joviality	21.1 (1.7)	25.6 (1.1)*	
Serenity	6.9 (.66)	9.0 (.42)**	
Self-Assuredness	16.1 (1.3)	20.2 (.82)**	

Note.  $n=41$  (29 experimental, 12 control). BSI= Brief Symptom Inventory; <sup>a</sup>Baseline > Last Day,  $p < .01$ . <sup>b</sup>Baseline > Last Day and Follow-Up,  $p$ 's < .05. <sup>c</sup>Last Day > Follow-Up,  $p < .05$ . <sup>d</sup>Last Day > Baseline and Follow-Up. <sup>†</sup> $p = .06$ . \* $p = .04$ . \*\* $p \leq .01$ .

$F(8,150) = 2.21$ ,  $p = .03$ ,  $\eta^2 = .11$ . Underlying univariate group effects were significant across all positive mood states: PA,  $F(1,39) = 7.2$ ,  $p = .01$ ,  $\eta^2 = .16$ ; joviality,  $F(1,39) = 4.5$ ,  $p = .04$ ,  $\eta^2 = .10$ ; serenity,  $F(1,39) = 7.1$ ,  $p = .01$ ,  $\eta^2 = .15$ ; and self-assuredness,  $F(1,39) = 7.58$ ,  $p = .009$ ,  $\eta^2 = .16$ . Table 3 displays descriptive statistics pertaining to these univariate group effects, whereby experimental participants show significantly elevated positive mood states compared to control participants. Significant univariate time effects were evident for PA,  $F(2,78) = 4.82$ ,  $p = .01$ ,  $\eta^2 = .11$ , joviality,  $F(2,78) = 6.32$ ,  $p = .003$ ,  $\eta^2 = .14$ , and serenity,  $F(2,78) = 8.45$ ,  $p < .001$ ,  $\eta^2 = .18$ . Bonferroni post-hoc analyses revealed participants to display significantly elevated PA at the second assessment relative to baseline, in addition to significantly elevated joviality and serenity at the second assessment relative to both baseline and follow-up (see Table 3).

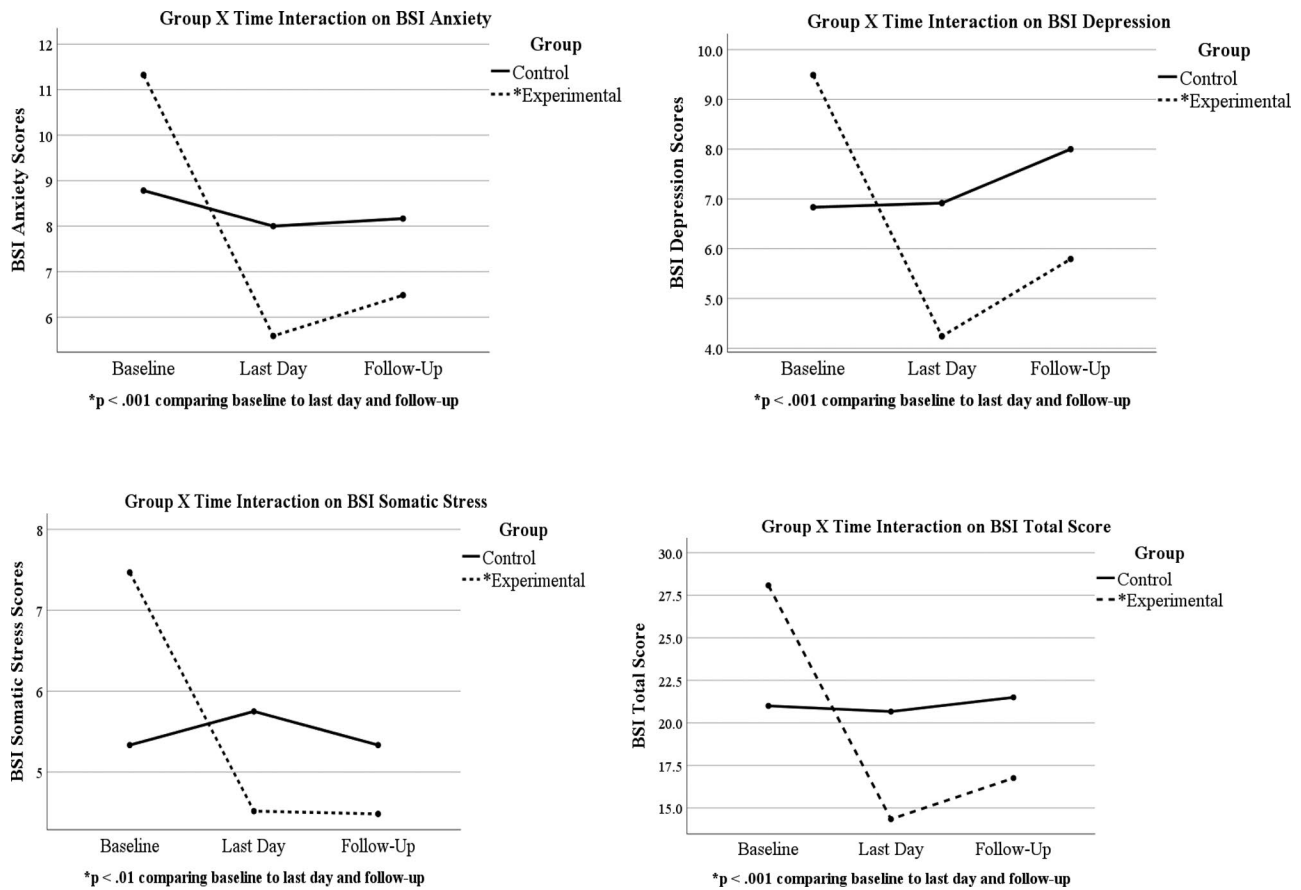
Significant group X time interaction effects were noted across all PANAS positive mood states: PA,  $F(2,78) = 4.59$ ,  $p = .013$ ,  $\eta^2 = .11$ ; joviality,  $F(2,78) = 7.31$ ,  $p = .001$ ,  $\eta^2 = .16$ ; serenity,  $F(2,78) = 6.01$ ,  $p = .004$ ,  $\eta^2 = .13$ ; and self-assuredness,  $F(2,78) = 5.96$ ,  $p = .004$ ,  $\eta^2 = .13$ . Figure 3 displays significant time related increases in PA, joviality, serenity, and

self-assuredness specific to experimental participants on the last day of their outdoor excursions. Control participants displayed non-significant time related changes on these variables. These findings suggest that the HFV experience effectively induces an acute state of calm, alert, happiness amid participants, coupled with an enhanced sense of confidence, effects that do not permeate to the follow-up assessment.

### PCL-M analyses

A  $2 \times 3$  (Group X Time) MANOVA on repeated measures evaluated significant differences in PCL-M total, hyper-arousal, intrusive thoughts, and avoidance behavior scores. A significant main effect was observed for time,  $F(6,152) = 3.27$ ,  $p = .005$ ,  $\eta^2 = .11$ , in addition to the group X time interaction,  $F(6,152) = 2.31$ ,  $p = .037$ ,  $\eta^2 = .08$ , whereas the main effect for group was non-significant,  $F(3,37) = .88$ ,  $p = .46$ ,  $\eta^2 = .07$ . Underlying univariate main effects for time were significant across all PCL-M variables: total score,  $F(2,78) = 9.33$ ,  $p < .001$ ,  $\eta^2 = .19$ ; hyper-arousal,  $F(2,78) = 5.97$ ,  $p = .004$ ,  $\eta^2 = .13$ ; intrusive thoughts,  $F(2,78) = 6.23$ ,  $p = .003$ ,  $\eta^2 = .14$ ; and avoidance behaviors,  $F(2,78) = 8.21$ ,  $p = .001$ ,  $\eta^2 = .17$ . Bonferroni post hoc analyses revealed significant





**Figure 1.** Group X time interactions on BSI variables.

Note.  $n = 41$ . Bonferroni post-hoc analyses revealed experimental participants to display significant reductions in anxiety, depression, somatic stress, and BSI total score comparing baseline to last day and follow-up, whereas control participants showed non-significant changes over time.

reductions in all PCL-M variables from baseline that were sustained at the 6 week follow up (see Table 3).

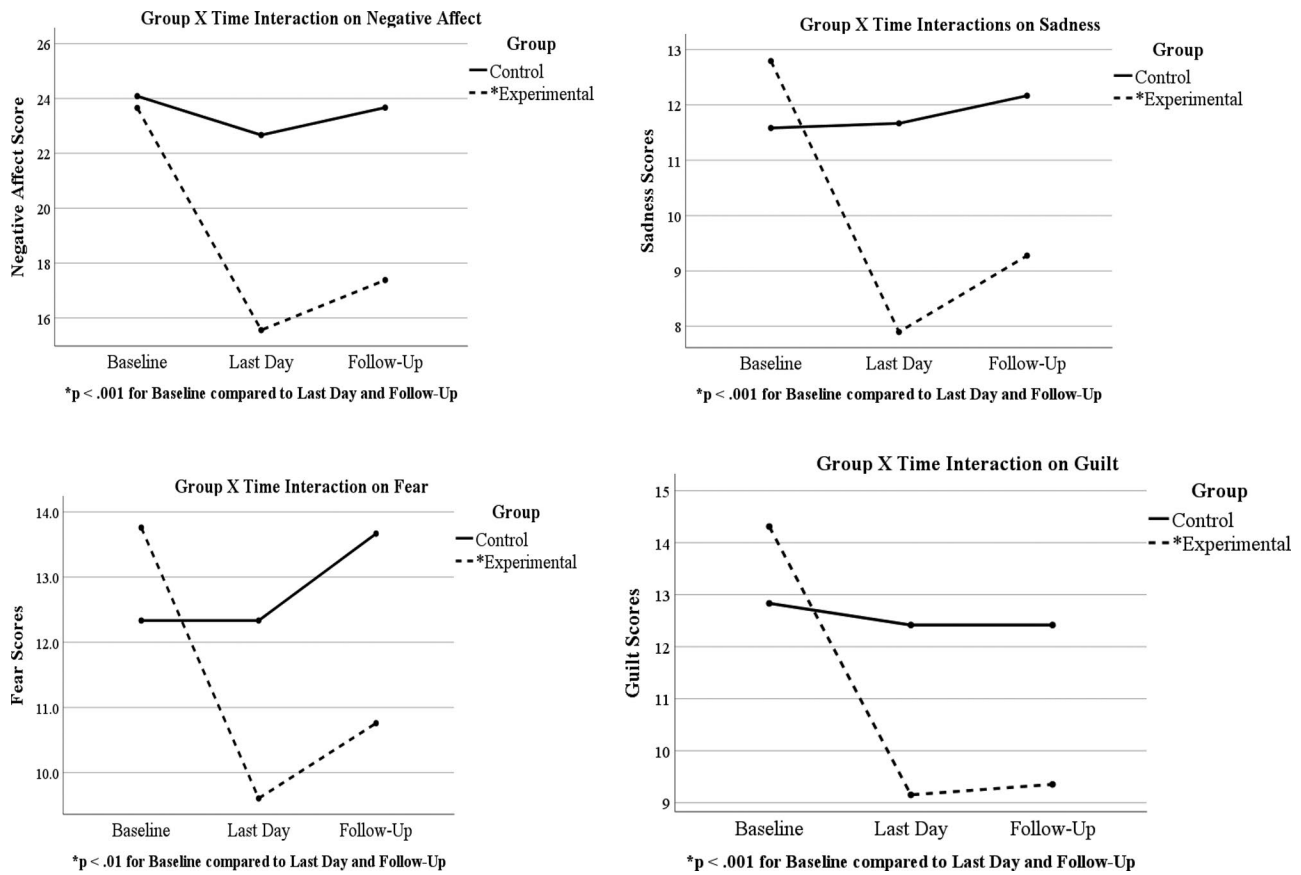
Significant univariate group X time interactions were noted for PCL-M total score,  $F(2,78) = 5.03$ ,  $p = .009$ ,  $p\eta^2 = .11$ , in addition to avoidance behaviors,  $F(2,78) = 6.12$ ,  $p = .003$ ,  $p\eta^2 = .14$ , whereas the interaction for hyper-arousal was marginally significant,  $F(2,78) = 2.87$ ,  $p = .063$ ,  $p\eta^2 = .07$ . Figure 4 displays significant time related decreases in PTSD symptomatology specific to the experimental participants. In particular, experimental participants showed significant reductions in PCL-M total, avoidance behaviors, and hyper-arousal scores from baseline through the 6 week follow up relative to the control group, which exhibited non-significant change.

## Discussion

The purpose of this pilot study was to evaluate the efficacy of a 3.5 day outdoor wilderness program for reduction of PTSD symptoms, negative mood states, and psychological distress, in addition to increases in positive mood states, among veterans. The results

suggest that outdoor therapeutic recreation can produce significant improvements in veteran psychosocial health. Main effects indicated significant decreases in depression, anxiety, and somatic stress symptoms from baseline to post-trip assessments. In addition, significant decreases in negative moods and overall PTSD symptomatology were found alongside significant increases in positive moods, exclusive to HFV participants. Moreover, the current therapeutic recreation program boasts psychosocial benefits that are maintained throughout the 6-week follow-up assessment.

The findings resonate with current literature supporting outdoor environmental leisure programs that have observed increases in quality of life, symptom management, and positive impacts on veterans suffering with PTSD, while also observing significant reductions in depression, anxiety and PTSD symptomatology (e.g., Greer & Vin-Raviv, 2019; Walker et al., 2020). These findings pair well with the theoretical orientations of leisure engendered social support and ART, whereby participation in outdoor therapeutic recreation programs with peers who have experienced similar life traumas elicit improvements in



**Figure 2.** Group X time interactions on PANAS variables: negative affect, sadness, fear, and guilt.

Note.  $n = 41$ . Bonferroni post-hoc analyses revealed experimental participants to display significant reductions in negative affect, sadness, fear, and guilt, reductions that were sustained at the 6 week follow-up. The control group participants displayed non-significant changes in all measures over time.

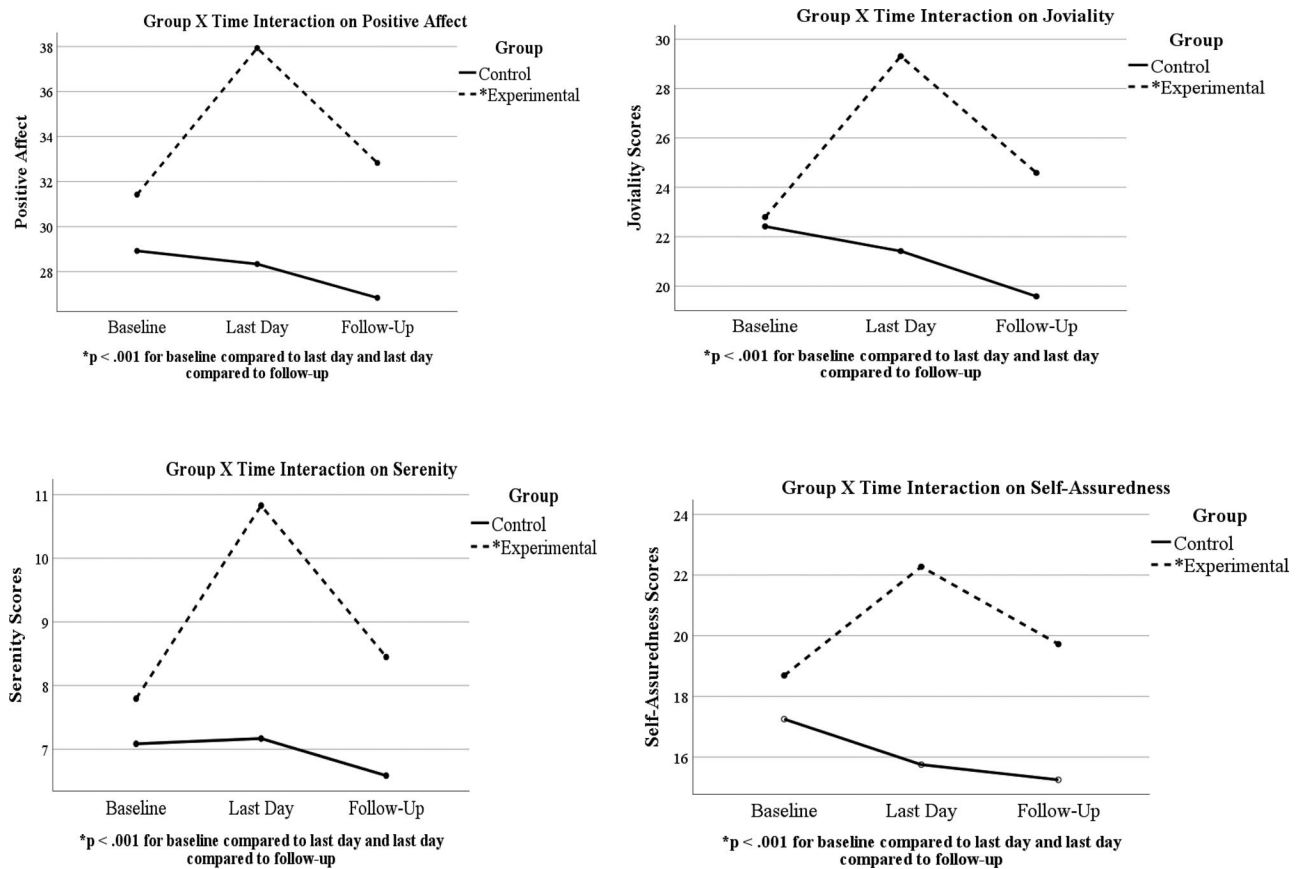
psychosocial wellness (e.g., Iso-Ahola & Park, 1996) and that spending time in a pristine natural environment replenishes attentional reserves (e.g., Hartig et al., 2003) as reflected by acute increases in PA, which includes items such as feeling ‘active’, ‘alert’, and ‘attentive’.

Other literature has found support for the notion that outdoor sport can enhance quality of life in combat veterans related to increased feelings of perceived competence in the associated physical activities (Lundberg et al., 2011), which can be paralleled to the hiking involved in the outdoor therapeutic recreation program of the current study, in addition to the acute increases observed in program participant self-assuredness. It has also been found that engaging combat veterans with PTSD in certain outdoor recreational activities, like fly-fishing, has therapeutic benefits that linked to increases in psychosocial wellbeing (Vella et al., 2013). Long-term health has also been shown to be positively affected in response to recreation-based wellness programs that center on the use of adaptive sports and recreation in conjunction with educational mental health counseling, which helps with the reintegration

process after injuries and mental health deficits (Townsend et al., 2018).

Outdoor support therapy programs have been found to provide veterans with a sense of shared identity, belongingness with others, and enhanced positive self-perceptions, which directly translate into improvements in quality of life (Bird, 2015). Positive improvements in mental health and psychosocial wellbeing were found to be longer lasting in response to outdoor social support programs whereby veterans are learning strategies to cope with their symptoms and are gaining a more positive self-perception in their own capabilities that are sustained far longer than just the time they spend in the program (Townsend et al., 2018). The HFV program involves group based discussions on targeted readings and presentations on stress and coping, which may have contributed to the favorable and sustained psychosocial profile exhibited by program participants.

The current study represents an evaluation of just one of the many outdoor therapeutic recreation programs that target the reduction of psychosocial concomitants of stress among combat veterans. Indeed, engagement in a variety of outdoor recreational sports



**Figure 3.** Group X time interactions on PANAS variables: positive affect, joviality, serenity, and self-assuredness.

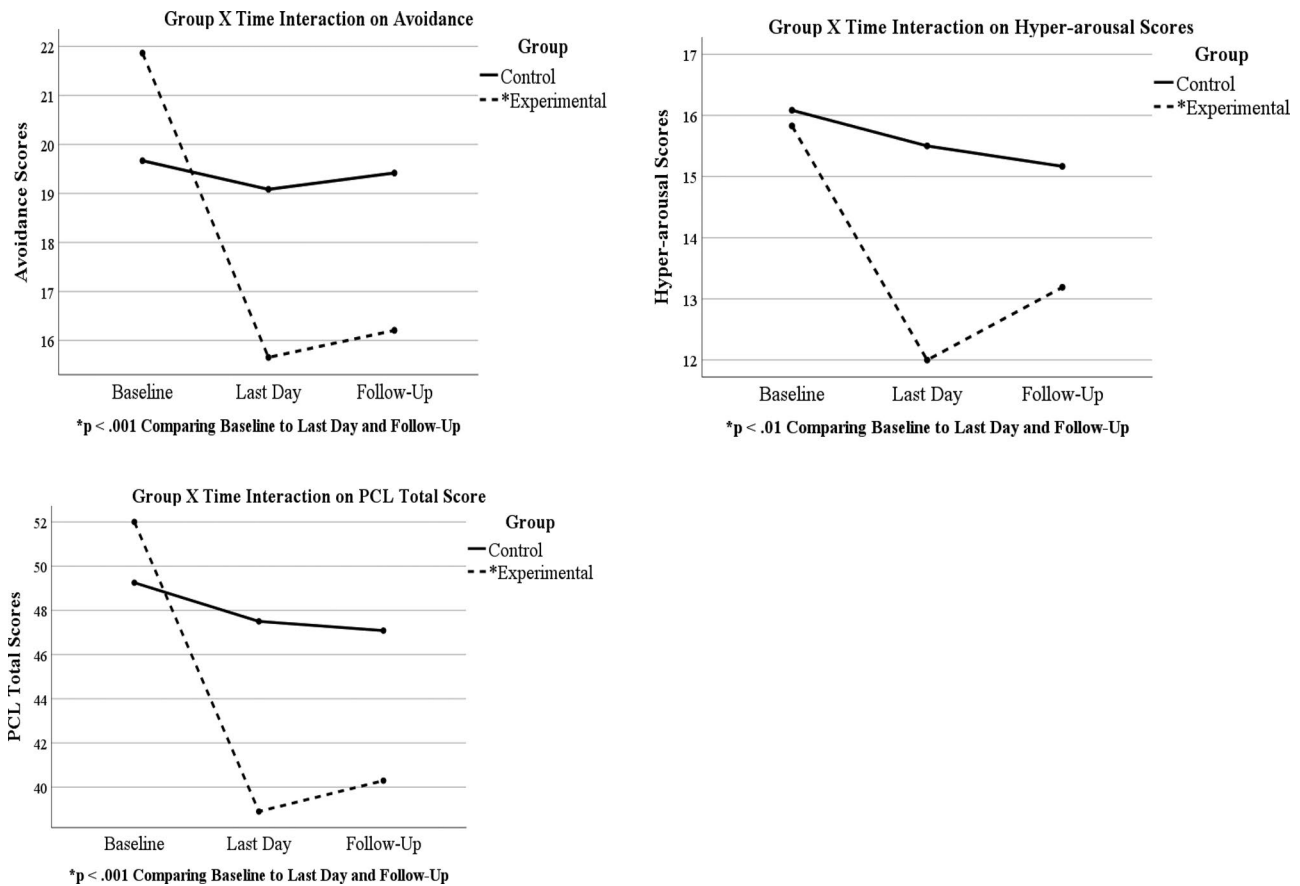
Note.  $n = 41$ . Bonferroni post-hoc analyses revealed experimental participants to display significant increases in positive affect, joviality, serenity, and self-assuredness on the last day of the outdoor excursion relative to baseline, whereas control participants showed non-significant changes over time.

have been associated with favorable psychosocial outcomes amid veterans (e.g., Walter et al., 2021). Programs like HFV are designed to not only intervene, but to actively reduce PTSD symptomatology and accompanying negative mood states that directly affect combat veteran quality of life. The current study features strengths that include the use of a waiting list control group and a 6 week follow up assessment. Participants from the waiting list control group were provided the opportunity to participate in the HFV program, but these participants were not monitored beyond the scope of assessments made in the current study. Future quasi-experimental investigations of similar outdoor therapeutic recreation programs for veterans should plan to expand their timeframe of assessments to include follow-up analyses on waiting-list control group participants, to ascertain whether they likewise benefit from the therapeutic interventions employed.

Though the cogency of the results is clear, the findings merit replication *via* randomized clinical trial (RCT), including a larger sample of veterans with a confirmed PTSD diagnosis and targeted assessments for specific qualities of the program that predict the

positive impacts of outdoor therapeutic recreation, such as program related increases in functional social support. Given the multi-modality nature of the HFV program, it will be important for subsequent research to ascertain the degree by which individual program components (e.g., leisure engendered social support, hiking, time spent in a natural environment, program readings/discussions) contribute to the overall results. Limitations also include possible self-selection bias affecting generalizability of the study due to veterans actively seeking complementary care for their combat related disabilities and an unequal distribution of veterans with a confirmed PTSD diagnosis in the experimental and control groups under investigation. Another limitation to the current study concerns the inability to rule out potential confounding variables that may exist between the experimental and control groups beyond the variables measured, a limitation common to quasi-experimental science, furthermore reinforcing a need for RCT replication of the current findings.

Future research should also aim to extend the time frame of their assessments to ascertain how long these observed reductions in PTSD, depression, and anxiety



**Figure 4.** Group X time Interactions on PCL variables: avoidance, hyper-arousal, and PCL total scores.

Note.  $n = 41$ . Bonferroni post-hoc analyses revealed experimental participants to display significant reductions in avoidance, hyper-arousal, and PTSD total scores, reductions that were sustained at the 6 week follow-up. The control group participants displayed non-significant changes in all measures over time.

symptomatology persist in relation to outdoor therapeutic recreation and ART therein. The current study used the 17 item PCL-M to assess PTSD symptomatology in accord with previous research (Vella et al., 2013), but future research may opt to make use of the 20 item PCL-5, which represents the more recent version of the inventory in accord with DSM-5 (Weathers et al., 2013).

Outdoor therapeutic recreation programs represent a promising avenue to pursue in favor of improving combat veteran psychosocial wellness and reducing PTSD symptomatology. The current study found evidence that participating in the HFV program elicited significant reductions in PTSD symptomatology, including reductions in avoidance and hyper-arousal symptoms that permeate to the 6 week follow up period. These results, alongside reductions in depression, anxiety, and negative mood states suggest that outdoor therapeutic recreation may represent a potent/cost efficient intervention worthy of subsequent investigation. Moreover, the acute increases in positive mood states observed in the current study suggest that outdoor therapeutic recreation elicits the added

benefit of inducing states of calm, alert, happiness amid combat veterans.

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