

Posttraumatic Stress Disorder Symptoms, Depressive Symptoms, Exercise, and Health in College Students

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Posttraumatic stress disorder (PTSD) symptoms have consistently been associated with poorer health in highly traumatized samples. However, less is known about the relationship between PTSD symptoms, depressive symptoms, and health in nonclinical groups. Because exercise contributes to health, we hypothesized that PTSD symptoms and depressive symptoms would be related to poorer health status, in part, through their association with lower exercise. We examined this in a sample of 200 undergraduates. Health status variables included functional health and negative health symptoms. Results indicated that greater PTSD symptoms and depressive symptoms were associated with poorer health status, and exercise mediated these relationships, in most cases. This study has implications for future research examining the effects of PTSD and depressive symptoms on health.

Keywords: PTSD symptoms, depressive symptoms, college students, exercise, health

Trauma significantly impacts physical and functional health, but these effects appear to be due largely to the psychological impact of trauma on physical health, as direct injury accounts for only a small portion of these associations (Friedman & Schnurr, 1995; Schnurr & Spiro, 1999). Instead, it has been shown that the development of post-traumatic stress disorder (PTSD) and depressive symptomatology largely mediates trauma's effects on poorer health (Clum, Calhoun, & Kimerling, 2000). Although the connections among PTSD symptoms, depressive symptoms, and health have been well established in highly traumatized groups, such as military veterans and victims of interpersonal assault (e.g., Koss, Koss, & Woodruff, 1991; Schnurr & Spiro, 1999; Waigandt, Wallace, Phelps, & Miller, 1990), there has been little examination of these associations in broader, community-based populations. It is important to examine these associations in young, nonclinical samples, as these samples may also experience significant trauma (Thatcher & Krikorian, 2005) that may impact upon health status.

Numerous studies have shown that exercise is associated with improved psychological well-being, health, and life satisfaction (Farmer, Locke, Moscicki, Larson, & Radloff, 1988; Meyer & Brooks, 2000). PTSD has been associated with a decrease in exercise activity among trauma victims. In an evaluation of physical activity among 50 male and female patients with PTSD, substantial changes in exercise were observed upon the onset of PTSD. Thirty percent of the active participants had been involved in physical activities before the onset of PTSD, and only 6% were engaged afterward (Assis et al., 2008).

Depression is an episodic illness characterized by low mood and loss of interest in activities that used to be enjoyable (Otter & Currie, 2004). Depression has also been consistently linked to a broad array of health conditions related to cardiovascular health (Ford, 2004). A negative association between depression and levels of physical activity has been found (Ford, 2004; Harris, Cronkite, & Moos, 2006). Thus, because PTSD and depressive symptomatology have been related to low levels of physical exercise, and more exercise accompanies better health, exercise as a mediator of PTSD and depressive symptoms and ratings of physical health functioning warrants direct examination.

In recent years, there has been an increased focus on examining unique relationships involving the three PTSD symptom clusters to determine how the clusters may differentially relate to other variables. The hyperarousal cluster, in particular, may have a unique role in predicting other aspects of the post-traumatic response (Schell, Marshall, & Jaycox, 2004; Taft et al., 2007). Kimerling,

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Clum, and Wolfe (2000) examined the separate PTSD symptom clusters as mediators explaining the association between traumatic exposure and reported health problems in 52 female Vietnam veterans. These researchers found that the hyperarousal cluster was uniquely associated with higher physical health symptom reports and poorer health perceptions, and posited that disturbances related to hyperarousal may be perceived as changes in health status.

The current study examined the relationships between self-reported PTSD symptoms and depressive symptoms and both negative health symptoms and functional health in a sample of male and female undergraduates. Negative health symptoms are defined here as health complaints, such as headaches and back problems, and functional health is defined as the degree to which health problems limit desired activities. We also examined the degree to which physical exercise accounts for the relationship between these mental health problems and health. The following hypotheses were tested: (a) PTSD symptoms and depressive symptoms would each be related to negative health symptoms and poorer functional health; (b) less physical exercise would be associated with more negative health symptoms and poorer functional health; (c) less physical exercise would statistically mediate the effects of PTSD symptoms and depressive symptoms on health-status variables; and (d) when disaggregating the symptoms of PTSD, hyperarousal symptoms would have the strongest relationships with health status variables. Finally, we explored associations between the PTSD symptom clusters and physical exercise to determine whether differential or unique relationships existed.

Method

Participants

Two hundred undergraduate introductory psychology students (75 males and 125 females) participated for course credit. Informed consent was obtained. This study was approved by the university Institutional Review Board at the research site. The average age for this sample was 18 years ($SD = 1.1$, ranging from 18 to 23 years). Over half of participants identified themselves as White or non-Hispanic Caucasian (59.8%), 17.1% as Asian American, 6.5% as Hispanic or Latino, 2.0% as Black or African American, and 14.6% as of other racial or ethnic groups.

Measures

Traumatic Life Events Questionnaire (TLEQ). The TLEQ (Kubany et al., 2000) was used to assess participant trauma history. This is a 24-item self-report instrument that asks about 22 types of potentially traumatic events. Events include physical and sexual abuse, exposure to interparental violence, natural disasters, motor vehicle accidents, warfare, sudden death of a loved one, physical assault, witnessing severe physical assault, life-threatening illness to self or loved ones, miscarriages, and abortions. Respondents were asked to indicate how often they experienced each event on a scale of "never" to "more than 5 times." If the respondent has experienced a particular event, they are then asked to indicate whether the event elicited fear, horror, or helplessness, information about relationship to the perpetrator when applicable, and whether the event resulted in injury. Respondents were also asked to indicate which trauma currently caused them the most distress. The

TLEQ has been found to have good content validity (Kubany et al., 2000). For the purpose of this study, the TLEQ was used to gain information about the trauma history profiles of this sample in order to understand how it might differ from treatment seeking samples, such as rape victims or military veterans.

PTSD Checklist–Civilian (PCL). The PCL (Weathers, Litz, Herman, Huska, & Keane, 1993) is a self-report measure assessing the 17 symptoms of PTSD based on diagnostic criteria from the *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. Respondents are asked to consider their most traumatic life experience and rate the degree to which they were bothered by each symptom in the past month. Individual items are rated on a 5-point scale ranging from 1 (*not at all*) to 5 (*extremely*), and these item scores are summed for an overall score. Scores for the three symptom clusters, reexperiencing (e.g., "repeated, disturbing memories, thoughts, or images of a stressful experience"), avoidance and emotional numbing (e.g., "avoiding thinking about or talking about a stressful experience or avoiding having feelings related to it" and "feeling emotionally numb or being unable to have loving feelings for those close to you since the event"), and hyperarousal (e.g., "feeling jumpy or easily startled since the event") were also calculated by summing the items in those clusters. This measure has been shown to exhibit high internal consistency, high test-retest reliability, high convergent validity with other measures of trauma and PTSD, and good sensitivity and specificity (Weathers et al., 1993). Coefficient alpha for overall PCL scores in this sample was .90, and subscale alphas for the PTSD cluster subscales ranged from .71 to .84.

Beck Depression Inventory II (BDI-II). The BDI-II (Beck, Steer, & Brown, 1996) is a 21-item self-report instrument designed to assess symptoms of depression. Respondents are asked to choose one of four statements of increasing symptom severity to describe how they have been feeling in the previous 2 weeks. Examples of items are "worthlessness," "indecisiveness," and "loss of energy." Items are summed for an overall score. Overall, the BDI-II has excellent demonstrated validity and reliability (Dozois, Dobson, Antony, & Barlow, 2002; Steer, Kumar, Ranieri, & Beck, 1998). Coefficient alpha for this sample was .90.

Health Risk Appraisal (HRA). An item from the HRA (Mendlowicz & Stein, 2000) was used to assess degree of engagement in regular physical exercise. The HRA is a 50-item self-report measure assessing health-related behaviors. The item used to assess exercise asks, "On the average, how many times per week do you engage in physical activity, exercise or work which increases the heart rate, causes you to breathe and sweat heavily, and is done for at least 20 minutes in duration? Examples include running, racquet sports, cycling, brisk walking or heavy labor, for example, chopping, lifting, digging, and so forth." Scores are reported in a frequency of 1 (*less than 1 time per week*), 2 (*1–2 times per week*), or 3 (*at least 3 times per week*).

Cohen-Hoberman Inventory of Physical Symptoms (CHIPS). Negative health symptoms were assessed using the CHIPS (Cohen & Hoberman, 1983), a 33-item self-report measure used to assess physical health symptoms. Respondents are asked to rate how much a particular physical health symptom has bothered or distressed them during the last 2 weeks. Examples of items include "Back pain" and "Diarrhea." Ratings are on a 5-point Likert-type scale ranging from 0 (*not been bothered by the problem*) to 4 (*the problem has been an extreme bother*). Items are

summed and averaged to yield a score between 0 and 4, with higher scores indicating more problems. Cronbach's alpha was .92.

Short Form Health Survey (SF-36). Functional health was assessed using the SF-36 (Ware & Sherbourne, 1992), a 36-item instrument used to assess health-related quality of life in eight domains: physical functioning, role limitations because of physical health problems, bodily pain, social functioning, general mental health, role limitations because of emotional problems, vitality, and general health perceptions. Examples of items include, "During a typical day, does your health now limit you in vigorous activities, such as running, lifting heavy objects, participating in strenuous sports," and, "During a typical day, does your health now limit you in bending, kneeling, or stooping?" Ratings for these items are 1 (*Yes, limited a lot*), 2 (*Yes, limited a little*), and 3 (*No, not limited at all*). Overall scores are transformed into a scale ranging from 0 (*least favorable health state*) to 100 (*most favorable health state*). Internal consistency and test-retest reliability have been cited in the adequate range (Mendlowicz & Stein, 2000). Cronbach's alpha was .88.

Analyses

SPSS 17.0 (SPSS, Inc., Chicago, IL) was used to conduct the analyses. Bivariate correlations were calculated to examine the relationships among all of the study variables, and the relative contributions of PTSD symptoms and depressive symptoms to health status were assessed using a linear regression. Cohen's (1988) guidelines were used to interpret effect sizes. We then tested our hypothesis that the relationships between PTSD and depressive symptoms and health status would be mediated by the exercise variable. As an alternative to the causal-steps approach for mediation (Baron & Kenny, 1986), we tested the significance of mediated pathways directly, as suggested by MacKinnon and colleagues (MacKinnon, Fritz, Williams, & Lockwood, 2007). We used the asymmetric distribution of products test, which has several advantages over the causal steps approach, including greater generalizability, increased power, and more appropriate type I error rates. To perform this test, the product of the two segments of the mediated pathway ($a \times b$) was calculated, as well as the associated asymmetric confidence intervals. The effect is significant if the confidence intervals do not include zero. Percent mediation was used as an index of effect size, calculated as the amount of the total relationship between the predictor and outcome variable (c' pathway) that is accounted for by the indirect ($a \times b$) pathway.

Results

Descriptives

The frequency for each type of trauma identified as causing the most current distress can be seen in Table 1. The "sudden death of a friend or loved one" was the most commonly endorsed event, with 22% of the sample reporting that as the event that caused the most distress, followed by "natural disaster" (8%) and motor vehicle or other accident (7.5%). Twenty-five percent reported witnessing or experiencing an interpersonal trauma, such as assault (1.5%), robbery (3%), witnessed or experienced domestic violence (6.5%), childhood or teen sexual abuse (5.5%), unwanted sexual

Table 1
Type of Event Reported as Most Distressing to Participant on Traumatic Life Event Questionnaire (N = 200)

Event	Frequency	Percent
Natural disaster	16	8.0
Motor vehicle accident	7	3.5
"Other" kind of accident	8	4.0
Sudden death of friend/loved one	44	22.0
Life-threatening/disabling event to loved one	12	6.0
Life-threatening illness	6	3.0
Robbery/weapon used	6	3.0
Assaulted by acquaintance/stranger	3	1.5
Witnessed severe assault to acquaintance/stranger	0	0
Threatened with death/serious harm	2	1.0
Growing up: witnessed family violence	7	3.5
Growing up: physically punished	6	3.0
Physically hurt by intimate partner	1	.5
Before 13: sexual contact—someone 5 years older	1	.5
Before 13: unwanted sexual contact	2	1.0
As a teen: unwanted sexual contact	8	4.0
As an adult: unwanted sexual contact	4	2.0
Sexual harassment	7	3.5
Stalked	6	3.0
Miscarriage	1	.5
Abortion	2	1.0
Some "other" traumatic event	10	5.0
None of these events happened to me	33	16.5
Missing information	8	4.0

contact as an adult (2%), sexual harassment (3.5%), or stalking (3%). Descriptives of all study variables are presented at the bottom of Table 2.

Bivariate Analyses

Bivariate correlations among study variables are presented in Table 2. As hypothesized, PTSD symptoms and depressive symptoms were both significantly associated with exercise and with negative health symptoms and functional health, such that reporting more PTSD and depressive symptoms was associated with decreased engagement in physical exercise and poorer health status. These associations were in the medium range for exercise and in the large range for both health variables. Also consistent with expectations, less-frequent exercise was associated with more negative health symptoms and poorer functional health at the bivariate level, with associations in the small to medium range (see Table 2).

Linear Regression Analyses

Results indicated that when examined simultaneously using a linear regression, PTSD symptoms ($B = -.31, p < .01$) and depressive symptoms ($B = -.626, p < .01$) both emerged as significant predictors of functional health, suggesting each accounted for unique variance in the outcome, and together explained 48% of the variance. Similarly, both PTSD symptoms ($B = .50, p < .01$) and depressive symptoms ($B = .55, p < .01$) contributed uniquely in the prediction of negative health symptoms, accounting for 27% of the variance.

The relative contributions of each of the three PTSD symptom clusters to exercise and the two health outcomes were examined using linear regressions (see Table 3). We found that hyperarousal

Table 2
Bivariate Correlations and Descriptives for Study Variables

Variable	1	2	3	4	5
1. PTSD symptoms					
2. Depressive symptoms	.74**				
3. Exercise	-.20**	-.29**			
4. Negative health symptoms	.50**	.49**	-.24**		
5. Functional health	-.63**	-.67**	.42**	-.64**	
Mean	28.61	9.27	2.28	23.2	78.44
Standard deviation	10.04	7.71	.76	16.66	10.56

* $p < .05$. ** $p < .01$.

symptoms had the strongest unique relationship with exercise; in fact, only hyperarousal remained a significant predictor in this analysis. Similarly, hyperarousal was also the only significant predictor of negative health symptoms and showed the strongest association with functional health, although in the latter case, avoidance and numbing also remained a significant unique predictor.

Tests of Mediation

Given that the bivariate relationships among PTSD and depressive symptoms and exercise and health status were significant and in the expected directions, we proceeded to test our hypothesis that exercise would act as a mediator. Table 4 presents the results of these tests. Results generally supported our hypothesis that exercise would mediate the relationship between PTSD symptoms and health status and also between depressive symptoms and health status, though the magnitude of these mediational effects was relatively modest. Exercise significantly mediated the relationship between PTSD symptoms and the two health outcomes, negative health symptoms and functional health, with indirect pathways accounting for 6% and 9% of the relationship, respectively. When tested as a mediator for depressive symptoms, exercise was a significant mediator only for functional health, accounting for 10% of the relationship. The indirect path was not significant for negative health symptoms.

Table 3
Linear Regression for PTSD Symptom Clusters Predicting Exercise, Negative Health Symptoms, and Functional Health

Variable	B	SEB	β	R^2	Adjusted R^2
	Exercise			.07	.05
Reexperiencing	.07	.02	.03		
Avoidance/numbing	-.00	.02	-.01		
Hyperarousal	-.06	.02	.26**		
	Negative health symptoms			.30	.29
Reexperiencing	.58	.37	.13		
Avoidance/numbing	.04	.33	.01		
Hyperarousal	2.48	.44	.47**		
	Functional health			.42	.41
Reexperiencing	-.27	.21	-.09		
Avoidance/numbing	-.53	.19	-.24**		
Hyperarousal	-1.33	.25	-.40**		

* $p < .05$. ** $p < .01$.

Table 4
Exercise as a Mediator of the Effects of PTSD and Depression on Health Status

Variable	Negative health symptoms		Functional health	
	B	t	B	t
PTSD				
Path a PTSD→exercise	-.015*	-2.86	-.015*	-2.86
Path b exercise→outcome	-5.28*	-3.47	5.74*	6.41
Path c PTSD→outcome	.83*	8.15	-.66*	-11.32
Path c'	-.78*	7.61	-.60	-10.80
Mediated path a*b	-3.17*	-2.34	4.17	5.75
Confidence interval	.006, .106*		-.113; -.021*	
Percent mediation	6%		9%	
Depression				
Path a depression→exercise	-.03*	-4.31	-.03*	-4.31
Path b exercise→outcome	-5.28*	-3.47	5.74*	6.41
Path c depression→outcome	1.05*	7.82	-.92*	-12.71
Path c'	.98*	7.03	-.82*	-11.42
Mediated path a*b	-2.32	-1.65	3.31*	4.54
Confidence interval	-.010; .163 ns		-.164; -.042*	
Percent mediation	—		10%	

* $p < .05$. ns = nonsignificant.

Discussion

This study examined mental health problems and exercise as correlates of physical and functional health. Study findings were generally consistent with the hypotheses. PTSD symptoms and depressive symptoms were both associated with poorer physical and functional health at the bivariate level and uniquely when examined together as predictors. The pattern of results was also consistent with the expectation that exercise would serve as a pathway through which these mental health difficulties would be associated with poorer health. Further, disaggregation of the PTSD symptom clusters suggested that hyperarousal was the strongest correlate of lower exercise and negative health symptoms. Avoidance and numbing symptoms also emerged as a significant correlate of poorer functional health in these analyses.

The finding that PTSD symptoms and depressive symptoms were related to poor health is consistent with prior research among samples of veterans and sexual-assault survivors (Lang et al., 2003; Ouimette et al., 2004; Schnurr & Green, 2004). The current investigation extends this body of research to a sample of college students that tended to report less severe forms of trauma. Further, prior studies examining the relationship between these mental health problems with indices of health have not considered their unique associations with these outcomes. Current findings suggest that PTSD and depressive symptoms each account for unique variance in both physical and functional health. Given the high comorbidity of PTSD and depressive symptoms, this research suggests that both should be considered when examining health symptoms.

To our knowledge, this is the first published investigation that establishes exercise as a significant mediator of the relationship between PTSD and depressive symptoms and poor health. Both PTSD and depression are characterized by a loss of interest and enjoyment in activities, and this may contribute to a loss of

motivation to engage in physical exercise. In the current sample, the avoidance and numbing PTSD cluster was, indeed, associated with functional health limitations. As expected, hyperarousal was the strongest correlate of health, supporting the idea that hyperarousal plays a unique role in the posttraumatic response. Hyperarousal also seemed to be the strongest correlate of lower physical exercise. One of the defining features of hyperarousal is heightened hypervigilance, which may make it difficult to exercise in venues that may involve interactions with or exposure to others (e.g., gym or fitness center).

This study was not without its limitations. We relied on self-reports of trauma and PTSD and did not link specific symptoms with traumatic events, preventing us from obtaining PTSD diagnostic information. Diagnostic clinical interviews assessing trauma and related symptoms of PTSD would clearly be preferable. Also, the sample for this study consisted of undergraduate psychology students at one university, and thus findings may not generalize to other nonclinical groups. The present study relied on participant self-report, which may have inflated associations between variables, and utilized a 1-item indicator of exercise, which may have served to lower overall associations with this variable and led to a relatively modest (yet significant) mediational effect. Future investigations should incorporate a more comprehensive, multimodal assessment of exercise and specific medical conditions (e.g., coronary disease, diabetes mellitus, and stroke). The cross-sectional data used in this investigation limit our ability to interpret causal directions. Prospective studies would more fully elucidate the relationships between mental health factors, exercise, and health. Finally, exercise accounted for a relatively small percentage of the relationship between PTSD and depressive symptoms and health. It is important to consider other mediators associated with PTSD and depression, such as anxiety sensitivity and an overactive stress response (Friedman & McEwen, 2004). It is also necessary to consider comorbid alcohol and substance abuse problems (Kessler, Sonnega, Bromet, & Hughes, 1995; Kulka et al., 1990). People experiencing symptoms of PTSD and depression may also have difficulty maintaining relationships and thus have decreased social support, a factor that has been shown to be related to health (Riggs, Byrne, Weathers, & Litz, 1998).

Despite these limitations, the present findings offer the first evidence that exercise may partially account for the relationship between PTSD and depressive symptoms and poor health. It is hoped that future research will further elucidate these complex relationships. The findings suggest the potential value of highlighting the benefits of exercise and positive health habits for this population, with respect to both mental and physical health.

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