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Physical health conditions associated with full and subthreshold PTSD in U.S. military veterans: Results from the National Health and Resilience in Veterans Study

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Abstract

Background: While both full and subthreshold posttraumatic stress disorder (PTSD) may be linked to physical conditions, contemporary population-based data on these associations in military veterans are scarce. Further, little is known about how component aspects of PTSD, which is a heterogeneous disorder, may relate to physical conditions in this population.

Methods: Data were analyzed from a population-based sample of 3157 U.S. military veterans who participated in the 2011 National Health and Resilience in Veterans Study. Multiple logistic regression analyses evaluated associations between full and subthreshold PTSD, and physical conditions.

Results: A total 6.1% of the sample met screening criteria for full PTSD and 9.0% for subthreshold PTSD. Both full and subthreshold PTSD were associated with increased odds of sleep disorder (adjusted odds ratio [AOR] = 3.52 and 2.10, respectively) and respiratory conditions (AOR = 2.60 and 1.87, respectively). Full PTSD was additionally associated with increased odds of osteoporosis or osteopenia (AOR = 2.72) and migraine (AOR = 1.91), while subthreshold PTSD only was associated with increased odds of diabetes (AOR = 1.42). Analyses of PTSD symptom clusters revealed that all of these associations were primarily driven by dysphoric arousal

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symptoms, which are characterized by sleep difficulties, anger/irritability, and concentration problems.

Limitations: The study used self-report measures for health conditions and DSM-IV diagnostic criteria for PTSD.

Conclusion: Results of this study provide a characterization of physical conditions associated with full and subthreshold PTSD in U.S. military veterans. They highlight the potential importance of PTSD dysphoric arousal in risk models of certain physical conditions in this population.

Keywords

PTSD; Physical health; Veterans; Dysphoric arousal

1. Introduction

Military veterans are at risk for poor physical health, given their increased likelihood of trauma exposure and the established association between trauma and physical health conditions (Lopez-Martinez et al., 2016). Post-traumatic stress disorder (PTSD) is prevalent in veterans, with almost 1 in 4 recent era veterans meeting diagnostic criteria for full PTSD (Fulton et al., 2015), and this clinical presentation may further contribute to risk for the development of negative physical health outcomes.

Compared to veterans without PTSD, those with trauma-related psychopathology have higher rates of cardiovascular, gastrointestinal, autoimmune, and musculoskeletal system diseases in addition to headaches (Boscarino, 2004). The existing literature is limited, however, by the narrow range of physical conditions assessed, the dearth of research assessing the impact of both full and subthreshold PTSD, and the lack of clarity regarding the facets of PTSD (symptomatology) driving comorbidities with particular physical conditions.

Although subthreshold PTSD is associated with both functional impairment and physical conditions (Pietrzak et al., 2011), comorbidity studies have largely focused on those who meet full diagnostic criteria for PTSD. The importance of examining subthreshold PTSD is high, given that PTSD presentations are heterogeneous (Yehuda and McFarlane, 1995), and the specific symptom clusters (e.g., arousal, reexperiencing) linked to physical conditions are unknown. It is possible that symptom clusters bear unique associations with physical conditions, as they do with psychological outcomes (Bell and Nye, 2007), and that poor physical health may exacerbate some symptom clusters more than others. In line with this, individuals with greater severity of certain PTSD symptom clusters could experience negative health outcomes with or without meeting full diagnostic criteria for PTSD. The emergence of pertinent symptom clusters may elucidate potential behavioural, cognitive, emotional, or physiological mechanisms driving comorbidity with physical conditions.

Using data from a large and contemporary nationally representative sample of U.S. military veterans, we examined the relation between full and subthreshold PTSD, and a range of physical conditions. We then evaluated associations between PTSD symptom clusters and significant comorbid conditions.

2. Methods

2.1. Sample

Data were analyzed from the National Health and Resilience in Veterans Study (NHRVS), a nationally representative survey of U.S. adult veterans conducted between October-December 2011 (n = 3157; Wisco et al., 2014). The NHRVS sample was drawn from a research panel of more than 50,000 households maintained by GfK, Inc (Menlo Park, CA). All respondents provided informed consent and the NHRVS received ethics approval.

2.2. Assessments

The Trauma History Screen (THS) assessed exposure to 13 potentially traumatic events. Participants were divided into two groups: no trauma exposure and trauma-exposed. The cumulative number of different trauma event types endorsed was also recorded.

The Posttraumatic Stress Disorder Checklist–Specific Stressor Version (PCL-S) assessed lifetime and past-month DSM-IV PTSD symptoms. A positive screen for full PTSD was based on meeting DSM- IV Criteria A through F in one's lifetime. A positive screen for subthreshold PTSD was based on meeting criteria A and exhibiting at least 1 moderate endorsement (≥ 3) within each of Criteria B, C, and D, lasting at least 1 month, in response to the worst event that involved intense fear, helplessness, or horror, actual or threatened death, serious injury, or threat to their or someone else's physical integrity (Breslau, Lucia, and Davis, 2004). PTSD symptom clusters were based on a five- factor model: re-experiencing, avoidance, emotional numbing, anxious arousal, and dysphoric arousal (Elhai et al., 2011). The five-factor model of PTSD has been validated among veterans (Pietrzak et al., 2012).

A self-report version of the Mini International Neuropsychiatric Interview (MINI) assessed lifetime prevalence of major depressive disorder (MDD), social phobia, alcohol and drug abuse/dependence, and nicotine dependence.

Lifetime physical conditions diagnosed by a health professional were self-reported. These included cardiovascular conditions (high blood pressure, high cholesterol, heart disease, heart attack, stroke), chronic pain conditions (arthritis, rheumatoid arthritis, chronic pain, migraine), osteoporosis and osteopenia, respiratory conditions (asthma, chronic bronchitis, chronic obstructive pulmonary disease), cancer, liver disease, diabetes, kidney disease, sleep disorder, and traumatic brain injury.

2.3. Data analysis

Weighted cross-tabulations, and bivariate and multiple logistic regressions assessed the association between group (no trauma exposure, trauma exposure alone, subthreshold PTSD, full PTSD) and individual physical conditions. The largest group (trauma exposure alone) was classified as the reference group. We conducted unadjusted models and models adjusting for (1) age, sex, ethnicity, marital status, household income, combat exposure, years in the military, and one further adjusting for (2) number of exposures to potentially traumatic events, and MDD, social phobia, and substance abuse/dependence. We also

reported secondary analyses examining whether cumulative lifetime trauma burden (indicated by number of lifetime trauma event types) was independently associated with physical conditions while additionally controlling for PTSD group. Finally, to examine the relation between PTSD symptom clusters and physical conditions, we conducted regression models using Mplus version 7. These models adjusted for sociodemographics, military characteristics, number of traumas, and other psychiatric disorders while accounting for intercorrelations among PTSD symptom clusters when assessing associations between PTSD symptom clusters and significant physical conditions in the comorbidity analyses. To permit generalizability to the U.S. veteran population, post-stratification weights based on the October 2010 Current Population Survey (U.S. Census Bureau, 2010) were applied.

3. Results

Table 1 shows sample characteristics. A total of 12.3% reported no trauma exposure (n = 384), 65.0% reported at least one lifetime trauma (n = 2078), 9.0% as having subthreshold PTSD (n = 289), and 6.1% were classified as having full PTSD (n = 182).

As shown in Table 2, in the most stringently adjusted model, both full and subthreshold PTSD were associated with increased odds of sleep disorder and respiratory conditions compared to those with trauma exposure alone. Compared to those with trauma exposure alone, full PTSD was additionally associated with increased odds of osteoporosis or osteopenia, and migraine, whereas subthreshold PTSD was associated with increased odds of diabetes. No trauma exposure, compared to the trauma-exposed group, was associated with decreased odds of high cholesterol and cancer.

Examining the effect of increasing number of different traumas in the most stringently adjusted models (that additionally controlled for PTSD group) revealed that a greater number of trauma event types was significantly associated with increased odds of traumatic brain injury, chronic pain, heart disease, heart attack, liver disease, respiratory disease, migraine, sleep disorder and arthritis (AOR range = 1.08–1.40).

Results of analyses examining the association between PTSD symptom clusters and the physical conditions associated with full PTSD in the most stringent model in Table 2 revealed that dysphoric arousal symptoms were significantly associated with increased odds of sleep disorder (AOR = 1.23, 95% CI = 1.16–1.30), migraine (AOR = 1.21, 95% CI = 1.13–1.31), osteoporosis or osteopenia (AOR = 1.21, 95% CI = 1.12–1.32), and respiratory diseases (AOR = 1.14, 95% CI = 1.09–1.19); re-experiencing symptoms were associated with migraine (AOR = 1.08, 95% CI = 1.03–1.13) and numbing symptoms with sleep disorder (AOR = 1.05, 95% CI = 1.01–1.09).

4. Conclusions

Results replicate and extend findings of previous studies indicating a significant association between PTSD and physical conditions among veterans (Boscarino, 2004). Both full and subthreshold PTSD were associated with respiratory conditions and sleep disorder. No trauma exposure was associated with decreased odds of high cholesterol and cancer in the adjusted model compared to those that were trauma exposed. A “dose response” pattern of

association emerged for several physical conditions with respect to cumulative number of trauma event types and physical conditions controlling for PTSD status, which has been observed in prior research (Husarewycz et al., 2014).

A prospective mechanism in the demonstrated relationship between PTSD and physical conditions involves trauma-induced alterations in hypothalamic-pituitary-adrenal (HPA) axis activity (de Kloet et al., 2006), producing inflammatory consequences linked to respiratory conditions, sleep disorders, bone deterioration (osteoporosis and osteopenia), and migraine. Given that subthreshold PTSD may share pathophysiological characteristics with PTSD (Costanzo et al., 2016), negative impact on physical health from non-clinical presentations of PTSD symptomology would be expected.

Novel findings of the current study include the unique link between subthreshold PTSD and diabetes, and the finding that, compared to trauma exposed veterans, no reported trauma exposure was associated with lower odds of having cancer and high cholesterol. In terms of subthreshold PTSD and diabetes, these unique findings may relate differential effects of type 1 versus type 2 diabetes on PTSD established in prior research (Tsai and Shen, 2017). These were not differentiated in this study. However, it is also possible that those with subthreshold PTSD self-manage their psychiatric symptoms with maladaptive eating behaviours. Eating high-sugar content foods has been associated with reduced HPA activity and subsequently lower perceived stress, yet in turn stress-motivated, high-caloric eating behaviours have been associated with diabetes (Tsenkova et al., 2013). Thus, one interpretation for this finding is that individuals with subthreshold PTSD, who may be more likely to employ coping strategies than those with full PTSD, have lower psychiatric symptom severity yet an increased risk of diabetes. Stress-related eating behaviours may also explain the protective effect of no trauma on cholesterol levels, given that trauma exposure is associated with disorderly eating habits (Mitchell et al., 2012). As high cholesterol has previously been linked to PTSD in veterans (Vilibić et al., 2014), and PTSD has been linked to cardiovascular conditions (Dedert et al., 2010), our results may reflect a “healthier-heart” lifestyle for non-trauma-exposed individuals. With regard to the cancer-related finding, our results accord with prior work suggesting no PTSD-cancer association (Gradus et al., 2015). The effect of no trauma exposure associated with reduced odds of cancer may be driven by the fact that cancer is more likely, relative to other health conditions, to be perceived as a traumatic experience, as suggested by prior research (Swartzman et al., 2016); therefore, this association may be related to this endorsement rather than a causal association. It is also possible, however, that no trauma is truly a protective factor against cancer through a variety of physiological and behavioural mechanisms.

Also unique to this study, dysphoric arousal symptoms, which are characterized by sleep difficulties, anger/irritability, and concentration difficulties (Armour et al., 2012), were significantly associated with all comorbid physical conditions associated with PTSD. The significance of this symptom cluster driving the effects of comorbidity compared to others may relate largely to difficulties with sleep. It is well known that sleep problems have a detrimental effect on physical health, and estimates suggest 70% of individuals with PTSD have sleep disturbances (Ohayon and Shapiro, 2000). It is therefore plausible that sleep dysfunction drives the relationship between PTSD and particular health problems, given that

associations have been established between all four relevant physical conditions (sleep disorder, migraine, osteoporosis or osteopenia, and respiratory diseases) and dysfunctional sleep (Dikmen et al., 2014; Leng et al., 2016; Yen et al., 2014). Additionally, sleep disorders evidenced the largest effect size with subthreshold and full PTSD in comorbidity analyses, further emphasizing its importance. Alternatively, dysphoric arousal symptoms may be capturing Type D (distressed) personality types, which have been previously linked to negative health outcomes (Versteeg et al., 2012). Type D individuals are prone to negative emotions, which may drive both sleep problems and perpetuate concentration difficulties. Although the etiology of this association is unclear, results of this study suggest that dysphoric arousal may be a potentially critical predictor in physical health sequelae in trauma-affected individuals. Future research could aim to examine if psychological and pharmacological targeted sleep interventions in PTSD populations may help mitigate risk of physical health comorbidity.

Methodological limitations of this study include the cross-sectional design, use of self-reported physical conditions, and adherence to DSM- IV diagnostic criteria, which has been replaced by the DSM-5. Notably, however, all 17 of the DSM-IV's PTSD symptoms were retained in the DSM-5's 20-symptom diagnostic criteria in the PCL. It should also be noted that over 60% of the sample was 60 years of age or older and therefore it is unclear whether these results would be maintained in samples of younger veterans. Further, given the large number of regression analyses along with the large sample size, the likelihood of type 1 error increases and therefore results, particularly those with smaller effect sizes, should be interpreted cautiously.

Notwithstanding these limitations, results of this study provide an up-to-date population-based characterization of physical conditions associated with full and subthreshold PTSD in U.S. military veterans. Importantly, they also underscore the importance of dysphoric arousal symptoms in the association between PTSD and physical conditions, but these results are preliminary. Further research is needed to evaluate causal/temporal associations between PTSD and physical conditions; identify protective factors that mitigate these associations (e.g., coping strategies); and evaluate the efficacy of prevention and treatment efforts for PTSD—particularly targeting dysphoric arousal—in reducing risk for physical health comorbidities and their negative health consequences.

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Table 1

Primary sample characteristics N = 3157.

	n(weighted %)
Age	
18–44	335(10.6)
60 +	2024(64.1)
Gender	
Male	2835(89.8)
Female	373(11.8)
Marital Status	
Married/Common Law	2349(74.4)
Widowed/Separated/Divorced/Single	808(25.6)
Household Income	
< $60,000	1509(47.8)
> $60,000	1648(52.2)
Current Employment Status	
Working	1285(40.7)
Retired	1474(46.7)
Education	
Less than High School	483(15.3)
Some college	1332(42.2)
BA/BS or higher	1342(42.5)
Region of Country	
South	1168(37.0)
West	833(26.4)
Midwest	767(24.3)
Northeast	385(12.2)
Branch of Military	
Army	1269(40.2)
Air Force	802(25.4)
Navy	720(22.8)
Marines	256(8.1)
Entry into Military	
Enlisted	2718(86.1)
Drafted	439(13.9)
Served in Combat/War Zone	
Yes	1105(35.0)
No	2052(65.0)
Wars in which Served	
Vietnam	1878(59.5)
Iraq/Afghanistan	328(10.4)
Persian Gulf	303(9.6)

	n(weighted %)
Korean	297(9.4)
World War II	129(4.1)

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Table 2

Association between PTSD status and physical conditions among U.S. veterans (N = 3157).

	No trauma exposure n = 384(12.3%)				Trauma exposed (Ref) n = 2078 (65.0%) n(%)	Partial PTSD n = 289(9.0%)				Full PISD n = 182(6.1%)			
Physical Conditions	n(%)	UOR 95%CI	AOR1 95%CI	AOR2 95%CI		n(%)	UOR 95%CI	AOR1 95%CI	AOR2 95%CI	n(%)	UOR 95%CI	AOR1 95%CI	AOR2 95%CI
Cardiovascular Conditions													
High Blood Pressure	177 (41.8)	**0.71 (0.57–0.89)** **	**0.79 (0.62–1.00)** *	0.96 (0.73–1.25)	1062 (50.2)	150 (45.6)	0.83 (0.65–1.07)	1.18 (0.90–1.56)	**1.00** (0.75–1.34)	94 (40.2)	**0.66 (0.49–0.89)** **	1.09 (0.78–1.53)	0.74 (0.51–1.09)
High Cholesterol	160 (34.3)	**0.56 (0.45–0.70)** ***	**0.57 (0.45–0.72)** ***	**0.61 (0.46–0.79)** ***	1062 (48.3)	140 (45.6)	0.90 (0.70–1.15)	1.22 (0.93–1.59)	1.04 (0.79–1.38)	93 (46.9)	0.95 (0.71–1.27)	**1.49 (1.07–2.06)** *	1.01 (0.70–1.46)
Heart Disease	30 (8.0)	**0.47 (0.32–0.69)** ***	**0.49 (0.33–0.74)** ***	0.82 (0.52–1.28)	315 (15.6)	43 (11.7)	0.93 (0.72–1.38)	1.01 (0.67–1.54)	0.82 (0.53–1.27)	27 (16.0)	0.98 (0.64–1.49)	**2.43 (1.52–3.87)** ***	1.50 (0.87–2.58)
Heart Attack	16 (4.6)	**0.47 (0.29–0.77)** **	**0.48 (0.29–0.81)** **	0.78 (0.45–1.37)	181 (9.5)	22 (7.1)	0.74 (0.46–1.18)	1.06 (0.64–1.75)	0.85 (0.50–1.43)	16 (5.7)	0.57 (0.30–1.06)	1.24 (0.63–2.46)	0.72 (0.34–1.54)
Stroke	6 (1.0)	0.45 (0.15–1.34)	0.53 (0.17–1.60)	0.67 (0.21–2.20)	39 (2.0)	11 (2.1)	1.13 (0.48–2.63)	1.65 (0.68–4.01)	1.39 (0.55–3.48)	8 (3.1)	1.55 (0.64–3.71)	2.47 (0.90–6.77)	1.57 (0.48–5.18)
Painful Conditions													
Arthritis	76 (19.1)	**0.55 (0.42–0.72)** ***	**0.58 (0.44–0.77)** ***	0.77 (0.57–1.06)	642 (30.0)	112 (30.7)	1.04 (0.79–1.36)	1.32 (0.98–2.98)	1.07 (0.79–1.45)	82 (39.2)	**1.49 (1.10–2.02)** **	**2.11 (1.50–2.98)** ***	1.30 (0.88–1.93)
Rheumatoid Arthritis	8 (2.1)	0.48 (0.23–1.02)	0.51 (0.24–1.10)	0.59 (0.26–1.34)	69 (4.0)	13 (3.2)	0.78 (0.38–1.57)	1.03 (0.49–2.13)	0.90 (0.42–1.90)	13 (7.2)	**1.89 (1.05–3.39)** *	**2.48 (1.27–4.81)** **	1.94 (0.89–4.22)
Chronic Pain	40 (10.8)	**0.50 (0.35–0.69)** ***	**0.53 (0.37–0.74)** ***	0.97(0.67–1.41)	371 (19.7)	74(25.1)	**1.35 (1.01–1.81)** *	**1.40 (1.03–1.90)** *	0.95 (0.69–1.32)	77 (42.3)	**2.98 (2.20–4.04)** ***	**2.95 (2.11–4.13)** ***	1.30 (0.88–1.92)
Migraine	11 (2.1)	**0.39 (0.19–0.83)** **	**0.35 (0.16–0.76)** **	0.52 (0.24–1.17)	109 (4.8)	27 (8.5)	**1.80 (1.13–2.87)** **	1.29 (0.78–2.12)	0.88 (0.52–1.49)	39 (22.8)	**5.89 (3.98–8.70)** ***	**4.20 (2.69–6.56)** ***	**1.91 (1.12–3.23)** *
Osteoporosis or Osteopenia	6 (1.0)	0.52 (0.19–1.39)	0.47 (0.17–1.31)	0.66 (0.22–1.94)	51 (2.1)	14 (3.5)	1.59 (0.78–3.23)	2.03 (0.95–4.32)	1.33 (0.60–2.98)	22 (9.8)	**5.01 (2.87–8.74)** ***	**6.85 (3.43–13.69)** ***	**2.72 (1.19–6.20)** *
Asthma, chronic bronchitis, COPD	20 (6.2)	**0.63 (0.41–0.98)** *	**0.64 (0.41–1.00)** *	0.98 (0.60–1.58)	207 (9.5)	50 (18.4)	**2.15 (1.54–3.01)** ***	**2.39 (1.68–3.40)** ***	**1.87 (1.29–2.70)** **	48 (30.4)	**4.14 (2.94–5.81)** ***	**4.70 (3.20–6.91)** ***	**2.60 (1.67–4.07)** ***
Cancer	40 (9.3)	**0.49 (0.34–0.71)** ***	**0.44 (0.30–0.65)** ***	**0.42 (0.28–0.63)** ***	366 (17.3)	43 (14.1)	0.80 (0.56–1.13)	**1.3** (0.93–2.01)	1.36 (0.92–2.03)	16 (4.6)	**0.22 (0.11–0.45)** ***	0.49 (0.23–1.05)	0.49 (0.22–1.11)
Liver Disease	**1** (0.3)	–	–	–	36 (2.1)	6 (2.1)	1.05 (0.45–2.45)	0.96 (0.40–2.30)	0.69 (0.28–1.71)	8 (3.6)	1.68 (0.74–3.82)	1.40 (0.58–3.37)	0.72 (0.26–1.94)
Diabetes	55 (12.3)	**0.66 (0.48–0.92)** **	**0.70 (0.50–0.98)** *	0.73 (0.51–1.06)	392 (17.5)	65 (19.8)	1.16 (0.85–1.59)	1.38 (0.99–1.92)	**1.42 (1.01–2.01)** *	43 (16.0)	0.89 (0.60–1.33)	1.20 (0.78–1.84)	1.26 (0.77–2.06)
Kidney Disease	10 (1.5)	0.59 (0.26–1.38)	0.74 (0.31–1.74)	0.75 (0.29–1.94)	49 (2.6)	11 (3.2)	1.25 (0.62–2.54)	1.38 (0.65–2.92)	1.25 (0.57–2.72)	5 (2.1)	–	–	–
Sleep Disorder	42 (11.8)	0.74 (0.53–1.03)	0.79 (0.56–1.11)	1.11 (0.77–1.61)	330 (15.3)	92 (33.9)	**2.84 (2.16–3.74)** ***	**2.72 (2.04–3.62)** ***	**2.10 (1.55–2.83)** ***	91 (54.6)	**6.72 (4.94–9.13)** ***	**6.13 (4.39–8.56)** ***	**3.52 (2.41–5.14)** ***
Traumatic Brain Injury	0 (0.0)	–	–	–	6 (0.5)	3 (0.7)	–	–	–	7 (2.6)	**5.43 (1.91–15.42)** ***	**9.80 (2.34–41.03)** **	2.91 (0.52–16.47)

Note.

* p ≤; 0.05

** p ≤; 0.01

*** p ≤; 0.001

Trauma exposed = reference group (odds ratio = 1.0). UOR = unadjusted odds ratio; AOR1 = adjusted for age, sex, income, marital status, ethnicity, year in the military, drafted or enlisted, combat exposure; AOR2 = adjusted for sociodemographics, military characteristics, number of traumas, any assessed psychiatric disorder (i.e., social phobia or MDD), any drug or alcohol use disorder, and nicotine dependence.

Prevalence is percentage of the physical condition among each PTSD group.