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Exacerbated PTSD symptoms among older U.S. military veterans during the COVID-19 pandemic: Results from the national health and resilience in veterans study

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A B S T R A C T

Research has demonstrated that the impact of the coronavirus 2019 (COVID-19) pandemic on the mental health of United States (U.S.) veterans was less negative than originally anticipated. However, U.S. veterans are susceptible to exacerbation of post-traumatic stress disorder (PTSD) symptomology in late life. The aims of this study were to examine the extent to which older U.S. veterans experienced an exacerbation of PTSD symptoms during the COVID-19 pandemic, and to identify pre- and peri-pandemic factors that conferred risk for symptom exacerbation. Participants were U.S. military veterans aged 60 and older who completed three waves of the 2019–2022 National Health and Resilience in Veterans Study (NHRVS) ($n=1858$). PTSD symptoms were measured at all waves using the PTSD Checklist for DSM-5, and a latent growth mixture model was conducted to compute latent slopes of change of PTSD symptoms over the 3-year period. 159 (8.3%) participants experienced a worsening of PTSD symptomology over the pandemic period. Factors related to PTSD exacerbation were incident trauma exposure between Waves 1 and 2, more medical conditions with onset prior to the pandemic, and peri-pandemic social restriction stress. Number of incident traumas moderated the relationship between both number of pre-pandemic medical conditions and pre-pandemic social connectedness, and exacerbated PTSD symptoms. These results suggest that the pandemic did not confer additional risk for PTSD exacerbation than would be expected over a 3-year period for older veterans. Those who experience incident trauma exposure should be monitored for symptom exacerbation.

1. Introduction

The coronavirus 2019 (COVID-19) pandemic and associated public health measures triggered increases in loneliness, depression, and anxiety for some older adults (Parlapani et al., 2021). Social isolation due to activity restrictions and decreased access to mental health services presented challenges for older persons at risk for psychological distress, including United States (U.S.) military veterans (Hill et al., 2021b). Older U.S. military veterans, though highly resilient, reported higher rates of loneliness, alcohol and other drug use, and posttraumatic stress disorder (PTSD) relative to older non-veterans (Williamson et al., 2018) prior to the pandemic.

Despite predictions that U.S. veterans would experience major psychological burden during the COVID-19 pandemic (Gerber, 2020), outcomes of research on this topic have been mixed. The prevalence of generalized anxiety disorder increased among U.S. veterans during the pandemic, but this was largely driven by younger veterans (Hill et al.,

2021b). Although some U.S. veterans developed new-onset suicidal ideation, past-year suicidal ideation was less prevalent during than before the pandemic began (Nichter et al., 2021a). In addition, more than 43% of U.S. veterans (of all ages) reported post-traumatic growth during the COVID-19 pandemic, including greater appreciation of life (Pietrzak et al., 2021).

Whether the COVID-19 pandemic exacerbated PTSD symptoms is not known. Approximately 10 percent of older U.S. veterans experience a late-life exacerbation of PTSD symptoms on average 30 years after their worst traumatic event, and research indicates social isolation, new traumatic event exposure, and loneliness are risk key factors for symptom exacerbation (Mota et al., 2016). It is plausible that the COVID-19 pandemic may have triggered an exacerbation of PTSD symptoms, as COVID-19 related activity restrictions limited access to social and instrumental support for older U.S. veterans (Hill et al., 2021b), and COVID-19 associated PTSD symptoms were reported by approximately 18% of the general population (Karatzias et al., 2020). The COVID-19

Abbreviations: U.S., United States; PTSD, Post-traumatic stress disorder; NHRVS, National Health and Resilience in Veterans Study.

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pandemic was also characterized by a higher potential for trauma exposure given the frequency of distressing incidents, including high mortality rates. Nevertheless, older U.S. veterans are highly resilient overall (Pietrzak and Cook, 2013), and studies with non-veteran populations have reported that older adults experienced less severe PTSD symptoms during the pandemic than their younger counterparts (Parlapani et al., 2021).

Understanding how the COVID-19 pandemic affected older U.S. veterans, and identifying those at risk for poor outcomes, is important to guide resource delivery in the case of future stressors. As such, the aims of this study were to examine the extent to which older U.S. veterans experienced an exacerbation of PTSD symptoms during the COVID-19 pandemic, and to identify pre- and peri-pandemic factors that conferred risk for symptom exacerbation.

2. Method

Data were analyzed from the 2019–2022 National Health and Resilience in Veterans Study (NHRVS), which surveyed a nationally representative sample of U.S. veterans in 2019 (pre-pandemic), 2020 (1-year peri-pandemic), and 2022 (2-years post-pandemic onset). The NHRVS is a population-based study of 4069 U.S. veterans, for which the sampling methodology has been described in detail elsewhere (Hill et al., 2021a). Briefly, the NHRVS sample was obtained from KnowledgePanel®, a probability-based survey panel of a representative sample of U.S. adults including more than 50,000 U.S. households. KnowledgePanel® is maintained by research firm Ipsos and covers approximately 98% of U.S. households. Panel members were recruited via telephone and postal mail through national random samples. To promote generalizability, Ipsos statisticians computed post-stratification weights following benchmark distributions of U.S. military veterans from the August 2019 Current Veteran Population Supplemental Survey of the U.S. Census Bureau's American Community Survey, which coincided with the 2019 pre-pandemic assessment. These weights were based on age, gender, race/ethnicity, Census Region, metropolitan status, education, household income, branch of military service, and years in service. Full details of the NHRVS post-stratification weighting can be found elsewhere (Nichter et al., 2021b). The NHRVS protocol was approved by the Institutional Review Board of the VA Connecticut Healthcare System, all participants provided informed consent, and the investigation was carried out in accordance with the latest version of the Declaration of Helsinki.

Recruitment for the pre-pandemic wave began in 2019 before the first documented case of COVID-19 and ended in 2019 before the first COVID-19 related activity restrictions in the United States. Peri-pandemic data were collected from 3078 U.S. veterans (75.6% of the original sample) during the fall and winter surges of COVID-19 cases in July–December 2020. Post-pandemic data ($n = 2441$; 60.0% of the original sample) were collected in 2022, when most U.S. residents had received a COVID-19 vaccination and mask mandates and social distancing policies were no longer enforced. The current study focused on veterans aged 60 years or older at the pre-pandemic assessment ($n=1858$) who completed all three survey waves (pre-pandemic, peri-pandemic, and post-pandemic).

3. Measures

3.1. Outcome

PTSD symptoms were measured at all waves using the PTSD Checklist for DSM-5 (PCL-5 (Weathers et al., 2013)), which assesses the severity of past-month PTSD symptoms in relation to the 'worst' Criterion A traumatic event endorsed on the Life Events Checklist for DSM-5 (LEC-5) (F. W. Weathers et al., 2013). The PCL-5 is a 20-item measure of past-month DSM-5 PTSD symptoms, with responses ranging from 0 (*Not at all*) to 4 (*Extremely*). A latent growth mixture model was conducted to

compute latent slopes of change of PTSD symptoms over the 3-year period. Exacerbated PTSD symptoms over the study period were defined as a standardized slope increase of 0.5 standard deviations or higher (Mota et al., 2016).

3.2. Factors associated with exacerbated PTSD symptoms

We examined the association of a broad range of sociodemographic, pre-pandemic (i.e. factors with onset prior to the pandemic), and pandemic-related factors on risk for exacerbated PTSD symptoms over the study period. A detailed list of measures used to assess these factors is presented in [Supplementary Table S1](#).

Sociodemographic factors included age (continuous variable), sex (male vs female), race/ethnicity (white non-Hispanic vs other), education (college graduate and higher vs lower than college graduate), marital status (married/partnered vs unpartnered), yearly income (>\$60k vs ≤\$60k), veteran status (combat vs non-combat), and number of years in military (10+ years vs < 10 years).

Pre-pandemic factors were those factors with onset prior to the COVID-19 pandemic, including the number of adverse childhood experiences (Finkelhor et al., 2015), number of lifetime traumatic events (Weathers et al., 2013), a positive screen at Wave 1 for major depressive disorder, generalized anxiety disorder, alcohol use disorder, and drug use disorder (Sheehan, 2016), subjective cognitive difficulties (Stewart et al., 1992), and loneliness (Hughes et al., 2004). Number of medical conditions was calculated from a self-reported list of 23 conditions, and participants completed checklists regarding their need for help with activities of daily living (ADL; e.g. bathing) (Hardy and Gill, 2004) and instrumental activities of daily living (IADL; e.g. shopping) (Lawton and Brody, 1969). A factor score representing positive psychosocial characteristics was computed from scales assessing purpose in life (Schulenberg et al., 2011), resilience (Campbell-Sills and Stein, 2007), optimism (Scheier et al., 1994), gratitude (McCullough et al., 2001), curiosity (Kashdan et al., 2009), and perceived community engagement. Finally, a factor score representing pre-pandemic social connectedness was computed from scales assessing perceived social support (Sherbourne and Stewart, 1991), number of close friends and relatives, and attachment style (Hazan and Shaver, 1987).

Pandemic-related factors were assessed at both Wave 2 and Wave 3 and included whether the respondent, a member of their household, or a non-household member had ever been infected with COVID-19, whether they had known someone who died of COVID-19, and their estimated number of hours of daily media exposure related to the COVID-19 pandemic. Four dimensions of COVID-19-associated worries and concerns were also assessed (National Institute of Mental Health, 2020): disease worries, social restriction stress, socioeconomic stress, and relationship difficulties. Finally, we examined the impact of increased alcohol consumption (Saunders et al., 1993), increased alcohol use problem severity (Saunders et al., 1993), increased days of non-prescription drug use (Tiet et al., 2015), and change in loneliness (Hughes et al., 2004) between Wave 1 and Wave 2.

3.3. Data analysis

Missing data (<5%) were missing completely at random according to Little's MCAR test. Imputation using chained equations was used to manage missing data. We first computed descriptive statistics to summarize sample characteristics and conducted latent growth mixture modelling (LGMM) to compute latent slopes to assess change in PTSD symptoms over the three study Waves. We computed bivariate comparisons (chi-square or t-tests, according to variable type) for each risk factor and factors significantly associated with exacerbated PTSD over time at $p < 0.05$ were entered into a multivariable logistic regression model with Forward Wald estimation. Interaction terms were then incorporated into the model to examine the combined effect of statistically significant factors in relation to exacerbated PTSD symptoms. A

relative importance analysis was conducted to estimate the relative variance in exacerbated PTSD symptoms that was explained by each significant independent variable (Tonidandel and LeBreton, 2010).

4. Results

4.1. Sample characteristics

Of the 1858 older U.S. veterans who completed all three waves of

data collection included here, 159 (8.3%) experienced a worsening of PTSD symptomology over the pandemic period (Table 1). On average, participants were 72.3 years old (SD = 7.4; range = 60–96), predominantly male (96.0%) and white, non-Hispanic (85.9%), and non-combat veterans (68.7%). There were no statistically significant demographic differences between those who did and did not experience an exacerbation of PTSD symptoms.

Table 1
Characteristics of U.S. Veterans with and without exacerbated PTSD symptoms during the COVID-19 pandemic.

	No Exacerbated PTSD Symptoms (n = 1,699, weighted 91.7%)	Exacerbated PTSD Symptoms (n = 159, weighted 8.3%)	Univariate test of difference	Multivariate odds ratio ^a	95% Confidence Interval
	Weighted mean (SD) or n (weighted %)	Weighted mean (SD) or n (weighted %)			
PCL-5 slope change over 3-year study	-0.1 (0.3)	0.8 (0.3)	30.81	-	-
Background characteristics					
Age	72.5 (7.3)	72.3 (7.3%)	0.32	-	-
Male sex	1585 (95.5%)	149 (96.4%)	0.16	-	-
White, non-Hispanic race/ethnicity	1486 (85.8%)	137 (87.3%)	0.18	-	-
College graduate or higher education	818 (31.7%)	83 (33.6%)	0.17	-	-
Married or partnered	1250 (74.8%)	120 (79.1%)	1.01	-	-
Household income >\$60K/Year	1,014 (55.5%)	99 (63.3%)	2.47	-	-
Combat veteran	550 (30.5%)	60 (35.3%)	1.18	-	-
10+ years in military	566 (30.5%)	57 (31.8%)	0.08	-	-
Pre-pandemic risk factors					
Adverse childhood experiences	1.1 (1.6)	1.6 (2.2)	3.23*	1.04	0.93–1.15
Cumulative traumas	7.5 (7.5)	11.2 (8.7)	4.89*	1.01	0.99–1.04
Index trauma			4.37	-	-
Disaster/accident	665 (45.5%)	60 (38.7%)	-	-	-
Illness/Injury to Self	471 (30.5%)	47 (34.0%)	-	-	-
Interpersonal violence	136 (8.9%)	22 (14.2%)	-	-	-
Combat/captivity	197 (13.9%)	20 (12.3%)	-	-	-
Injury/Harm/Death to Other	19 (1.2%)	2 (0.9%)	-	-	-
PTSD symptoms	5.4 (9.1)	4.9 (6.4)	0.49	-	-
Positive screen for MDD	59 (3.0%)	5 (4.6%)	0.82	-	-
Positive screen for GAD	44 (2.3%)	7 (7.3%)	9.35*	1.30	0.49–3.42
Alcohol use disorder	120 (7.3%)	19 (11.0%)	1.90	-	-
Drug use disorder	103 (6.1%)	15 (9.3%)	1.69	-	-
Loneliness	4.2 (1.6)	4.6 (1.6)	2.57*	0.91	0.78–1.06
Subjective cognitive difficulties	0.0 (1.0)	0.6 (1.2)	6.25*	1.01	0.84–1.21
Number of medical conditions	3.2 (2.1)	4.5 (2.2)	6.24*	1.17	1.06–1.28
ADL disability	54 (3.3%)	14 (10.1%)	12.35*	1.68	0.73–3.86
IADL disability	142 (8.4%)	29 (22.0%)	21.29*	2.27	1.30–3.96
Protective psychosocial characteristics	0.0 (1.0)	-0.3 (0.9)	3.14*	0.87	0.67–1.14
Social connectedness	0.0 (1.0)	-0.3 (1.0)	3.48*	0.76	0.61–0.94
Pandemic-related risk factors					
COVID-19 infection to self	639 (37.1%)	63 (39.4%)	0.24	-	-
COVID-19 infection to household member(s)	514 (30.5%)	55 (37.3%)	2.15	-	-
COVID-19 infection to non-household member(s)	1390 (79.1%)	123 (75.2%)	0.89	-	-
Know someone who died of COVID-19 complications	115 (7.2%)	19 (7.3%)	0.01	-	-
Daily hours of COVID-19 media exposure	1.6 (2.0)	1.8 (2.8)	0.90	-	-
Pandemic-related worries	0.1 (1.0)	0.3 (1.0)	1.97*	1.14	0.93–1.40
Pandemic-related social restriction stress	-0.1 (0.9)	0.3 (1.0)	4.13*	1.28	1.05–1.57
Pandemic-related financial stress	-0.2 (0.8)	0.2 (1.0)	4.12*	1.18	0.97–1.43
Pandemic-related worsening of relationships	0.0 (0.9)	0.1 (1.0)	1.26	-	-
Increased alcohol use problems	-0.1 (1.8)	0.1 (2.2)	1.11	-	-
Increased loneliness	0.0 (1.2)	0.1 (1.4)	0.51	-	-
Traumas from Wave 2 to Wave 3	1.4 (2.3)	3.2 (3.5)	7.42*	1.19	1.12–1.26

*Univariate test of difference statistically significant to $p < 0.05$ and variable included in multivariate logistic regression model.

Abbreviations: ADL = Activities of Daily Living; COVID=Coronavirus; GAD = Generalized Anxiety Disorder; IADL=Instrumental Activities of Daily Living; MDD = Major Depressive Disorder; PTSD=Post-traumatic Stress Disorder.

^a Calculated only for variables retained in final logistic regression model.

4.2. Factors associated with exacerbation of PTSD symptoms

Relative to veterans without exacerbated PTSD symptoms, those with exacerbated symptoms reported a greater number of healthcare professional-diagnosed medical conditions with onset prior to the pandemic, particularly chronic pain (40.8% vs. 19.9%; odds ratio [OR] = 1.97, 95% confidence interval [CI] = 1.25–3.11) and migraine (11.9% vs. 4.4%; OR = 2.34, 95%CI = 1.14–4.80). They were also more likely to report a disability in one or more pre-pandemic IADLs and scored lower on a measure of pre-pandemic social connectedness (i.e., less provided supported, OR = 0.92, 95%CI: 0.88–0.98). None of the other pre-pandemic variables entered into the multivariable model, including age, lifetime trauma load, and baseline PTSD symptoms, were associated with exacerbated PTSD symptoms (all p 's > 0.10).

Of the pandemic-related factors examined, only pandemic-related social restriction stress was associated with exacerbated PTSD symptoms. Veterans who experienced a greater number of incident traumatic events during the pandemic (i.e. Waves 2 and 3) were also more likely to experience exacerbated PTSD symptoms. Relative importance analysis including variables that were statistically significant at the $p < 0.05$ level in the logistic regression model (Nagelkerke $R^2 = 0.21$) revealed that a greater number of incident traumatic events during the pandemic (45.7%), pre-pandemic diagnosis of chronic pain (17.2%), and lower levels of peri-pandemic provided support (12.3%), accounted for the majority of explained variance in predicting exacerbated PTSD symptoms. The remainder of the explained variance was accounted for by IADL disability (10.1%), pandemic-related social restriction stress (7.5%), and migraine (7.2%).

After incorporating interaction terms into the logistic regression model, the number of incident traumatic events between Waves 2 and 3 emerged as a significant moderating factor between number of pre-pandemic medical conditions and exacerbated PTSD symptoms (OR = 0.97, 95%CI: 0.94–0.99; Fig. 1a). The number of incident traumatic events also moderated the impact of pre-pandemic social connectedness on this outcome (OR = 1.07, 95%CI: 1.01–1.14), though the protective effect of social connectedness was less influential for those with the highest frequency of trauma exposure (Fig. 1b).

5. Discussion

It was broadly anticipated that the spread of COVID-19 might disproportionately impact older veterans with past trauma histories and related symptoms. In this longitudinal study of older U.S. veterans, 8.3% of participants experienced an exacerbation of PTSD symptoms over 3-years of the COVID-19 pandemic. This incidence is similar to that reported in previous, non-COVID specific studies of older U.S. veterans (Mota et al., 2016), older Israeli veterans (Horesh et al., 2013), and World War II Prisoners of War (Port et al., 2001), suggesting the pandemic did not confer any additional risk for PTSD exacerbation than would be expected over a 3-year period for older veterans. This finding is also consistent with other studies which found that U.S. veterans are highly resilient to the negative impacts of COVID-19 (e.g. Fischer et al., 2023).

Veterans who were exposed to new traumatic events during the study period were at higher risk for PTSD symptom exacerbation, particularly where they had more medical conditions and lower social support prior to the pandemic. This is consistent with evidence that renewed trauma exposure can trigger distress associated with previous events, even when index events occurred many years prior (Horesh et al., 2013). The frequency of distressing events such as COVID-19-related mortality rates, particularly among individuals with pre-existing medical conditions, was high during the COVID-19 pandemic. Thus, older veterans with pre-existing medical conditions and low levels of social support may have been more vulnerable to exacerbated PTSD symptoms because they may have felt more vulnerable, socially isolated, and less able to cope with incident traumas (Mota

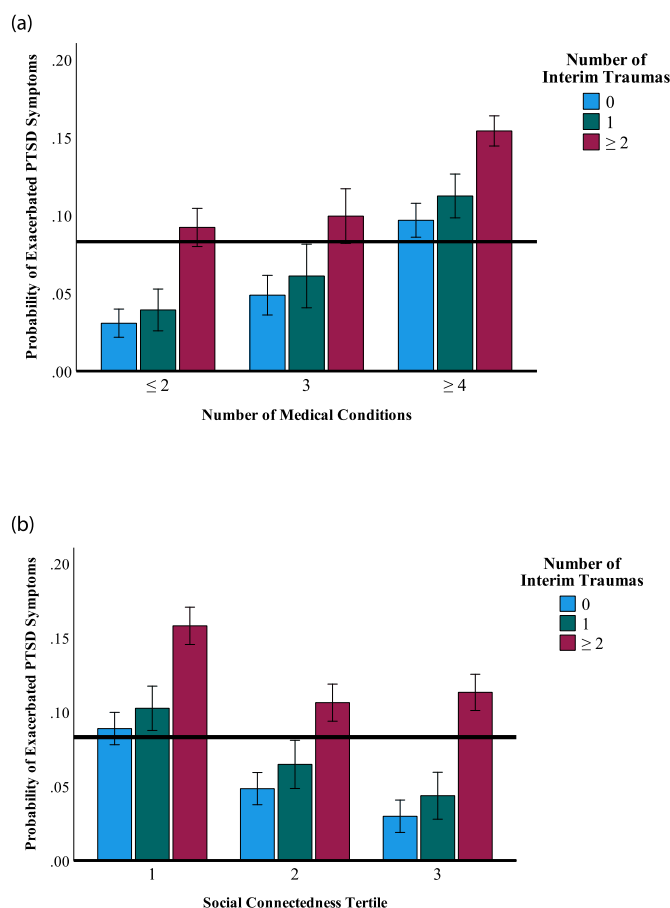


Fig. 1. Interaction between incident traumatic event exposure and (a) number of medical conditions and (b) social connectedness, on worsening PTSD symptoms during the COVID-19 pandemic

Note. Horizontal black line represents mean probability of exacerbated PTSD symptoms in the full sample (0.083). Interaction term in multivariate logistical regression model: OR = 0.97, 95%CI: 0.94–0.99. Categories are tertiles of number of medical conditions and interim traumas derived from the full sample. Note. Horizontal black line represents mean probability of exacerbated PTSD symptoms in the full sample (0.083). Interaction term in multivariate logistical regression model: OR = 1.07, 95%CI: 1.01–1.14. Categories are tertiles of social connectedness scores and interim traumas derived from the full sample.

et al., 2016). Clinically, these findings underscore the importance of educating older veterans, particularly those with pre-existing medical and psychiatric conditions, and their families about the protective effects of social support and adaptive coping strategies. In addition, delivering rapid interventions (e.g. brief psychotherapy, social support programs) to older U.S. veterans exposed to new traumatic experiences during pandemics or other disasters may help prevent PTSD symptom exacerbation.

Results of the current study are also generally consistent with data from an ongoing study of civilians aged 50 and older following the beginning of the COVID-19 pandemic (Rutherford et al., 2021). In that study, PTSD symptoms declined among those with PTSD relative to trauma-exposed healthy controls despite increased social isolation, physical illness, and pandemic-related media exposure. Taken together, these findings suggest that a diagnosis of PTSD should not be assumed to confer vulnerability to continued or exacerbated symptoms in older adults.

Strengths of this study include the large and representative sample of older U.S. veterans and the longitudinal design. There were no significant differences in baseline PTSD symptoms between those who

experienced an exacerbation of symptoms and those who did not, increasing confidence that the effects identified here were related to the COVID-19 pandemic. Limitations of this study include that the use of self-assessment tools to measure PTSD symptoms and other constructs may be less reliable than a clinician-administered diagnostic interview. The ‘worst event’ used to assess PTSD symptoms may have changed between study waves. It is also possible that COVID-19 related distress (e.g. worries, perceived worsening of relationships) and PTSD symptoms overlapped rather than reflected distinct constructs. In addition, the sample comprised predominantly white, non-combat veterans. While results are representative of the older U.S. veteran population, generalizability to more diverse populations may be limited. Further research on the impact of the COVID-19 pandemic in these subpopulations is needed to help fill this research gap.

Author contributions

MC conceptualized this study and drafted and edited the manuscript. JC and IF contributed to study development and manuscript editing. RHP is the principal investigator of the National Health and Resilience in Veterans Study and was responsible for funding acquisition, data collection and analysis, and drafting and revising the manuscript.

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Declaration of competing interest

None of the authors have any relevant conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2023.05.078>.

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