



# Psychological Resilience in U.S. Military Veterans: Results from the 2019–2020 National Health and Resilience in Veterans Study

Michael F. Georgescu<sup>1</sup> · Ian C. Fischer<sup>2,3</sup> · Sarah Lowe<sup>1,2</sup> · Robert H. Pietrzak<sup>1,2,3</sup>

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## Abstract

Following exposure to traumatic life events, most individuals are psychologically resilient, and experience minimal-to-no symptoms of posttraumatic stress, major depressive, or generalized anxiety disorders. To date, however, most research has focused on factors associated with adverse post-trauma mental health outcomes rather than understanding those associated with psychological resilience. In particular, little is known about factors associated with psychological resilience in veterans, despite their high rates of trauma exposure, such as combat and military sexual trauma. To address this gap, we used a discrepancy-based psychiatric resilience (DBPR) analytic approach to operationalize psychological resilience, and to identify modifiable health and psychosocial factors associated with resilience in a nationally representative sample of U.S. veterans ( $N=4,069$ ). DBPR scores were computed by regressing a composite measure of distress (posttraumatic stress, major depressive, and generalized anxiety disorder symptoms) onto measures of adverse childhood experiences, combat exposure, military sexual trauma, and cumulative potentially traumatic events (e.g., natural disaster, life-threatening illness/injury). Psychological resilience was operationalized as lower actual, relative to predicted, composite distress scores. Results revealed that greater emotional stability (22.9% relative variance explained [RVE]) and mindfulness (13.4% RVE), lower likelihood of lifetime histories of MDD or PTSD (12.8% RVE), greater purpose in life (11.9% RVE), and lower severity of somatic symptoms (10.8% RVE) explained the majority of the variance in resilience scores (total  $R^2=0.40$ ). Taken together, results of this study illustrate the utility of a DBPR score approach to operationalizing psychological resilience to traumatic stress in U.S. veterans, and identify several modifiable health and psychosocial factors that can be targeted in prevention and treatment efforts designed to bolster resilience in this population.

**Keywords** Psychological resilience · Trauma · Stress · Posttraumatic stress disorder · Depression · Anxiety

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Robert H. Pietrzak had full access to the data used in this manuscript.

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## Introduction

The ability to overcome challenges or “bounce back” after traumatic events and other challenges have been defined as psychological resilience [1]. However, numerous definitions and operationalizations of resilience have been put forth over time. Resilience has been theorized to be a stable personality trait [2–5], a dynamic process that varies depending on the context [6], a multifactorial construct [7], or an outcome [8, 9]. There has been debate about the appropriate way to conceptualize, define, and operationalize resilience. Even though these theoretical frameworks and characteristics differ, across all of these definitions, resilience has been found to be the most common response to trauma and other life adversities. To date, the vast majority of studies of resilience have focused on *psychological* resilience, which is typically operationalized as no/minimal psychological distress (i.e., posttraumatic stress, depressive, and anxiety symptoms) despite enduring high levels of exposure to trauma and other stressful events.

Due to their higher rates of potentially traumatic events (PTEs), such as combat, veterans have a greater likelihood of developing stress-related disorders [10] than non-veterans, and constitute a unique cohort in which to evaluate possible modifiable aspects of resilience. Over the past ten years, there have been changes in the demographic composition of the veteran population (e.g., there are more women, more college-educated veterans, and less likely to be non-Hispanic White), and these trends are anticipated to continue [11]. Therefore, the identification of modifiable targets for prevention and treatment efforts to promote resilience is critically needed. Recently, Overstreet et al. [14] used a discrepancy-based psychiatric resilience (DBPR) analytic approach to operationalize resilience and examine the potential psychosocial factors of resilience in a nationally representative sample of U.S. veterans. The DBPR scoring approach was developed by Amstadter et al. [12], who used an abbreviated version of the Symptom Checklist-90 [13] to assess the number of psychiatric symptoms (e.g., depressive and anxiety symptoms), which were then regressed onto stressor/trauma burden (i.e., number of traumatic and other life-long stressful events) to compute DBPR scores. Greater resilience was operationalized as lower than predicted psychiatric symptoms as a function of greater stressor/trauma burden.

The Overstreet et al. [14] study was the first to employ a DBPR analytic approach in veterans, but there is a need to update these results using up-to-date information. First, they used a 2011 cohort of veterans and the now-outdated DSM-IV version of the PTSD Checklist. Since 2011, there have been changes to the demographics of US military veterans from the most recent Pew Research Center study [15], so the results of this study may not generalize to the current veteran population, and a DSM-5 version of the PCL is now available [16]. Second, to compute DBPR scores, they relied on the PTSD Checklist-Specific Stressor Version (PCL-S), thus not considering other mental health symptoms that are common following exposure to traumatic events, such as depressive and anxiety symptoms [17–19]. Third, the study focused on a limited set of psychosocial factors that have been linked to resilience, such as gratitude, curiosity, and altruism, and did not consider many other psychosocial factors that have been identified as pertinent to psychological resilience [20], such as grit [21] defined as the capacity to sustain both effort and passion for a long-term goal [22], coping strategies [23–27], or mindfulness [28, 29], characterized by a greater tendency to approach negative thoughts and feelings in a positive way without trying to avoid or control them [30] and a lower likelihood of engaging in avoidance coping strategies from a stressful or traumatic event [27].

To address these limitations of Overstreet et al. [14], we sought to replicate and extend their work in three ways. First, we examined correlates of resilience in a more recent and larger nationally representative sample of U.S. military veterans. Second, using a contemporary DSM-5-based measure of PTSD symptoms, we calculated DBPR scores using a composite of PTSD, major depressive disorder (MDD), and generalized anxiety disorder (GAD) symptoms, which construes trauma-related psychopathology more broadly. Third, we broadened our assessment of modifiable psychosocial factors of resilience (i.e., protective psychosocial characteristics, social connectedness, social engagement, altruism, and religiosity/spirituality, physical health difficulties), including coping strategies [23–26], mindfulness [28, 29], and grit [21]. We had two aims: (1) to utilize the DBPR approach to quantify psychological resilience using measures of PTSD, MDD, and GAD symptoms; and (2) to identify sociodemographic, health, and psychosocial factors associated with resilience; and utilize novel data analytic approach called relative importance analysis [31] to characterize the largest magnitude correlates of resilience, which may help inform prevention and treatment efforts to help bolster resilience in U.S. military veterans.

## Material and Methods

### Participants

Data were analyzed from the 2019–2020 National Health and Resilience in Veterans Study (NHRVS), which surveyed a nationally representative sample of 4,069 US military veterans between November 2019 and March 2020 (median completion date: November 21, 2019). Each veteran who participated in the study anonymously filled out the online survey. The NHRVS cohort was drawn from KnowledgePanel, a probability-based survey panel that includes nearly 98 percent of United States households. The research company Ipsos maintains data on more than 50,000 households for KnowledgePanel. Members were first signed up over the phone, then by postal mail using nationwide random sampling. Ipsos developed a post-stratification weight using benchmarks of the distributions of US veterans from the most contemporaneous Veterans Population Supplemental Survey of American Community Survey (August 2019): age, sex, race/ethnicity, metropolitan status, education, household income, a branch of service, and years of service. An iterative proportional fitting procedure (ranking) was utilized to provide a final post-stratification for weights. Participants in the study gave their informed consent electronically. The Human Subjects Subcommittee of the VA Connecticut Healthcare System approved the study.

### Assessments

**Sociodemographic Characteristics** Participants in the study responded to a questionnaire about their age, sex, race/ethnicity, current marital status, annual household income, job status, military branch, years of service, usage of VA health care services, and status as combat veterans.

**Adverse Childhood Experiences** The Adverse Childhood Experiences (ACEs) questionnaire [32] was used to assess exposure to adverse childhood events. This measure assesses 10 types of childhood maltreatment (i.e., physical, emotional, and sexual abuse and

physical and emotional neglect), as well as household dysfunction (i.e., parental separation or divorce, witnessing parental abuse, household substance abuse, household mental illness, and household incarceration); Cronbach's  $\alpha=0.76$ .

**Combat Exposure Scale** The Combat Exposure Scale [33] (CES), which assesses frequency of exposure to seven types of combat experiences (e.g., number of times under enemy fire, going on combat patrols, or other dangerous duty), was included. Higher scores reflect greater intensity of combat exposure, and non-combat veterans received a score of 0; Cronbach's  $\alpha=0.86$ .

**Military Sexual Trauma** Endorsement of one or both items from the Veteran Health Administration Military Sexual Trauma [34] (VHA MST) screen assessing for exposure to military sexual harassment (MSH) and military sexual assault (MSA) was considered a positive screen for MST. MSH was assessed using an item, which asked, "When you were in the military, did you ever receive unwanted, threatening, or repeated sexual attention?" MSA was assessed using an item, which asked, "When you were in the military, did you have sexual contact against your will or when you were unable to say no?"

**Life Event Checklist-5 (LEC-5)** Participants completed the LEC-5 [16], in which they indicated whether they experienced 17 PTEs in their lifetime, including the nature of their exposure (i.e., direct, witnessed it, learned about it happening to close family or friend, or were exposed to it as part of my job. Individuals can choose more than one exposure type for each PTE experienced. A broad range of PTEs are assessed, including disasters/accidents (e.g., natural disasters, explosions, transportation accidents); interpersonal violence (e.g., physical assault, sexual assault, assaulted with a weapon); combat or captivity; illness or injury (e.g., severe human suffering, sudden violent death, sudden accidental death); and serious injury, harm, or death to another person. The total number of direct trauma exposures (i.e., "happened to me") within a range of 0 to 17 was used to compute the cumulative direct trauma burden. The total number of indirect exposures ("witnessed it," learned about it happening to close family or friend," and "exposed to it as part of my job") between 0 to 51 was used to compute the cumulative indirect trauma burden.

**PTSD Checklist for DSM-5 (PCL-5)** The PCL-5 [35] is a self-report questionnaire with 20 items corresponding to symptoms of PTSD as defined in the DSM-5. Symptoms were rated in relation to each person's self-reported "worst" PTE on the LEC-5, using a 5-point Likert scale from 0 (not at all) to 4 (extremely). The PCL-5 [36] has demonstrated strong psychometric validity in other studies, and the current study has demonstrated excellent internal consistency (Cronbach's  $\alpha=0.96$ ). A cut score of 33 or higher is indicative of a positive screen for PTSD [37].

**MDD and GAD Symptoms (PHQ-2)** Symptoms of current major depressive disorder (MDD) were assessed using the Patient Health Questionnaire (PHQ-2) [38]. The PHQ-2 includes two items (e.g., frequency of depression and anhedonia over the past 2 weeks) rated from 0 ("not at all") to 6 ("nearly every day"). Scores of 3 or higher are indicative of a positive screen for MDD (Cronbach's  $\alpha=0.87$ ). Symptoms of generalized anxiety disorder (GAD) were assessed using the GAD-2 [39]. The GAD-2 included two items (e.g., feeling nervous, anxious, or on edge, and not being able to stop or control worrying) rated from 0 ("not at all") to 6 ("nearly every day"). Scores of 3 or higher are indicative of a positive screen for GAD (Cronbach's  $\alpha=0.84$ ).

Supplemental Table 1 describes sociodemographic, military, health, and psychosocial measures that were examined as potential correlates of DBPR scores.

## Data Analysis

Data analyses proceeded in six steps. First, we computed descriptive statistics to compute the prevalence of positive screens for PTSD, MDD, and/or GAD. Second, to generate a composite psychological distress score, an exploratory factor analysis with promax rotation was conducted. This analysis included total scores on measures of PTSD, MDD, and GAD symptoms. Third, to compute DBPR scores, distress composite scores were regressed onto trauma exposure variables, which included ACES, cumulative trauma burden, MST, and individual traumatic event types. Residual scores from this analysis were saved and inverted so that higher scores reflected greater resilience (i.e., lower actual relative to predicted raw distress scores (i.e., lower DBPR score)); a scatterplot was generated to illustrate the relationship between observed and predicted scores. Fourth, bivariate correlations between DBPR scores and sociodemographic, military, and other resilience factors were conducted; variables reflecting broad factors (i.e., protective psychosocial characteristics, social connectedness, social engagement, altruism, and religiosity/spirituality, physical health difficulties) were reduced using exploratory factor analyses (EFA) with promax rotation. Fifth, variables associated with DBPR scores at the  $p < 0.05$  level in bivariate analyses were entered into a multivariable linear regression analysis to examine independent correlates of DBPR scores. Sixth, a relative importance analysis [31] was conducted to determine the relative variance in DBPR scores of each significant correlate identified in the multivariable model. This analysis decomposes the overall variance explained by regression models into proportional contributions while accounting for intercorrelations among these variables, thus quantifying the relative significance of each individual correlate of DBPR scores.

## Results

### Composite Psychological Distress Score

Results of an exploratory factor analysis of PTSD, MDD, and GAD symptom scores revealed that these scores all loaded on a single factor (eigenvalue = 2.26, 75.5% cumulative variance explained). Factor loadings ranged from 0.816 for PTSD symptoms to 0.896 for MDD symptoms). A total of 475 (14.2%) veterans screened positive for at least one of these disorders.

### Trauma Exposure

In the full sample, the total number of lifetime PTEs was 8.9 (SD = 8.5), with direct (M = 3.2, SD = 2.5) and “learned about” (M = 2.4, SD = 3.5) PTEs being the most common, followed by “witnessed” (M = 2.3, SD = 2.8) and “part of the job” (M = 1.1, SD = 2.5) PTEs. On average, the sample reported 1.5 (SD = 2.0) ACEs, and 7.5% screened positive for MST. The

most prevalent index traumas were “transportation accidents” (15.7%), “combat or war-zone exposure” (11.9%), “natural disasters” (11.8%), “life-threatening illness or injury” (10.6%), and “witnessing/learning about sudden violent death” (6.3%).

### Computation of Discrepancy-Based Psychiatric Resilience Scores

A linear regression analysis revealed a significant association between ACES, cumulative trauma burden, MST, individual traumatic event types, and DBPR scores ( $F=17.05$ ,  $p<0.001$ ,  $R^2=0.26$ ). The strongest correlates of DBPR scores included “learned about” PTEs ( $\beta=0.23$ ,  $p<0.001$ ), “combat exposure severity” ( $\beta=0.18$ ,  $p<0.001$ ), “childhood emotional neglect” ( $\beta=0.17$ ,  $p<0.001$ ), number of ACEs ( $\beta=0.15$ ,  $p<0.001$ ), “witnessing serious injury, harm, or death to someone” ( $\beta=0.09$ ,  $p<0.001$ ), and MST ( $\beta=0.16$ ,  $p=0.002$ ). Figure 1 shows the distribution of DBPR scores in our sample.

### Bivariate Correlates of DBPR Scores

Table 1 shows the bivariate correlations between DBPR scores and other variables in the analysis. As shown, DBPR scores were significantly and positively correlated with several sociodemographic characteristics (e.g., “age”, “education”, “married/partnered”) and psychosocial factors (e.g., “emotional stability”, “grit”, “mindfulness”). In contrast, DBPR scores were negatively correlated with indicators of military status (e.g., “combat veteran”), psychiatric history (e.g., “lifetime PTSD”, “lifetime alcohol and/or DUD”, “received mental health treatment”), maladaptive coping strategies (e.g., “venting”, “self-distraction”, “self-blame”), and physical symptoms (e.g., “somatic symptoms”, “the sum number of medical conditions”, “any disability in activities of daily living”).

### Multivariable Linear Regression

Table 1 also shows the results of a multivariable linear regression model predicting DBPR scores, which collectively explained 40% of the variance in these scores. As shown, sociodemographic factors (e.g., “married/partnered”) and psychosocial factors (“extraversion”, “emotional stability”, “purpose in life”, “grit”, “mindfulness”) were associated with higher scores, and health-related factors (e.g., “somatic symptoms”, “instrumental activities of daily living”) were associated with lower scores.

### Relative Importance Analysis

As shown in Fig. 2, the factors that accounted for the largest magnitude of variability in DBPR scores ( $R^2=0.40$ ) were “emotional stability” (22.9%), “mindfulness” (13.4%), “lifetime MDD or PTSD” (12.8%), “purpose in life” (11.9%), and “somatic symptoms” (10.8%). Other factors that explained the variability in DBPR scores were “grit” (5.7%), “IADL disability” (5.7%), “received social support” (5.6%), “community integration” (3.7%), “extraversion” (3.5%), “agreeableness” (1.9%), and “acceptance-based coping” (1.3%), “private spiritual activities” (0.6%), “intrinsic religiosity” (0.4%), “married/partnered” (0.3%), “days visit family” (0.1%).

**Table 1** Sociodemographic, Military, and Resilience-Related Variables, and Their Bivariate and Multivariable Association with Discrepancy-Based Psychiatric Resilience Scores (n=4,069)

	N (weighted %) mean (SD)	Bivariate correlation with DBPR scores <i>r</i>	Multivariable association with DBPR scores ( $R^2 = 0.40$ ) $\beta$
<i>Sociodemographic characteristics</i>			
Age	62.2 (15.7)	0.18***	0.02
Male sex	3,564 (90.2%)	-0.01	—
White race/ethnicity	3,318 (78.1%)	0.01	—
College degree or higher education	1,827 (32.7%)	0.06***	0.01
Married/partnered	2,885 (72.4%)	0.05**	0.04*
Currently employed	1,611 (48.2%)	0.00	—
Household income \$60 K +	2,357 (58.5%)	0.10***	-0.01
<i>Military characteristics</i>			
Combat veteran	1,353 (35.0%)	-0.05**	-0.01
10+ years in military	1,476 (36.4%)	0.00	—
<i>Psychiatric and substance use disorder history</i>			
Lifetime positive screen for PTSD or major depressive disorder [76]	808 (21.8%)	-0.42***	-0.17***
Lifetime alcohol and/or drug use disorder[77]	1,673 (43.2%)	-0.13***	0.02
Ever received mental health treatment	908 (22.6%)	-0.31***	-0.03
<i>Personality characteristics [78]</i>			
Extraversion	3.8 (1.5)	0.21***	0.05***
Agreeableness	5.0 (1.2)	0.19***	-0.09***
Conscientiousness	5.7 (1.2)	0.28***	-0.01
Emotional stability	5.2 (1.4)	0.49***	0.26***
Openness to experiences	4.8 (1.2)	0.18***	0.02
<i>Protective psychosocial characteristics</i>			
Resilience [78]	39.1 (6.8)	0.37***	0.02
Purpose in Life [79]	21.2 (4.9)	0.39***	0.14***
Gratitude [80]	6.2 (1.2)	0.25***	0.03
Community integration	4.1 (1.8)	0.27***	0.04*

**Table 1** (continued)

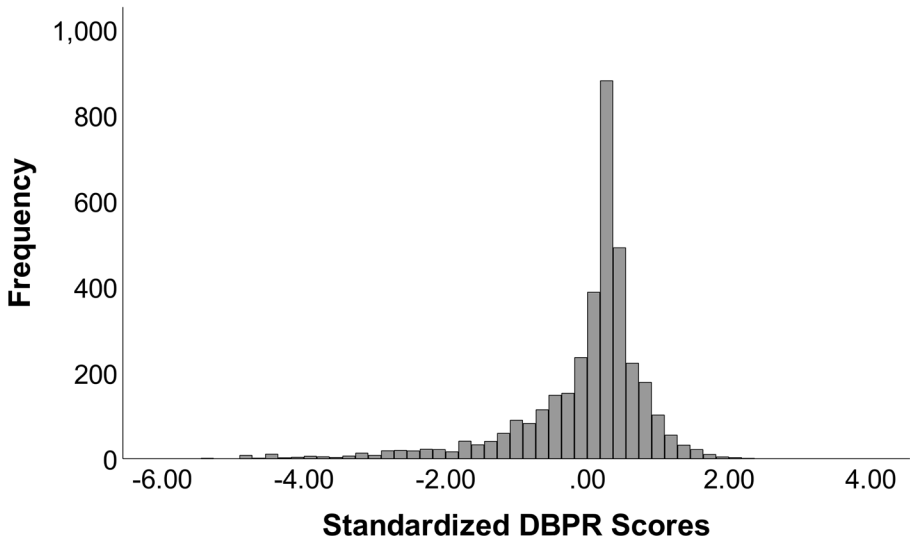
	N (weighted %) or weighted mean (SD)	Bivariate correlation with DBPR scores <i>r</i>	Multivariable association with DBPR scores ( $R^2 = 0.40$ ) $\beta$
Optimism [81]	5.0 (1.5)	0.32***	0.02
Curiosity/exploration [82]	5.0 (1.4)	0.24***	0.02
Grit [22]	2.7 (0.6)	0.35***	0.05**
Mindfulness [44]	5.0 (1.1)	0.42***	0.14***
<i>Self-sufficient coping strategies</i>			
Acceptance	1,721 (38.9%)	0.11***	0.05***
Religion	867 (19.5%)	0.01	–
Active coping	785 (18.7%)	0.04*	0.01
Humor	781 (18.2%)	-0.01	–
Positive reframing	630 (14.1%)	0.08***	0.01
Planning	412 (9.5%)	0.05**	0.04
<i>Socially oriented coping strategies</i>			
Use emotional support	610 (14.3%)	-0.01	–
Venting	395 (10.6%)	-0.13***	-0.06
Use instrumental support	136 (3.2%)	-0.04**	-0.02
<i>Avoidance coping strategies</i>			
Self-distraction	1,463 (36.3%)	-0.08***	–
Substance Use	343 (9.8%)	-0.15***	-0.06
Behavioral disengagement	216 (5.9%)	-0.14***	-0.04
Self-blame	230 (5.5%)	-0.17***	-0.04
Denial	141 (4.1%)	-0.17***	-0.10
<i>Social connectedness</i>			
Number of close friends and relatives	8.1 (10.9)	0.12***	0.01
Secure attachment [83]	2,870 (67.3%)	0.28***	0.01
Received social support [84]	18.5 (5.2)	0.29***	0.04**
Provided social support [84]	19.0 (4.3)	0.25***	0.00



**Table 1** (continued)

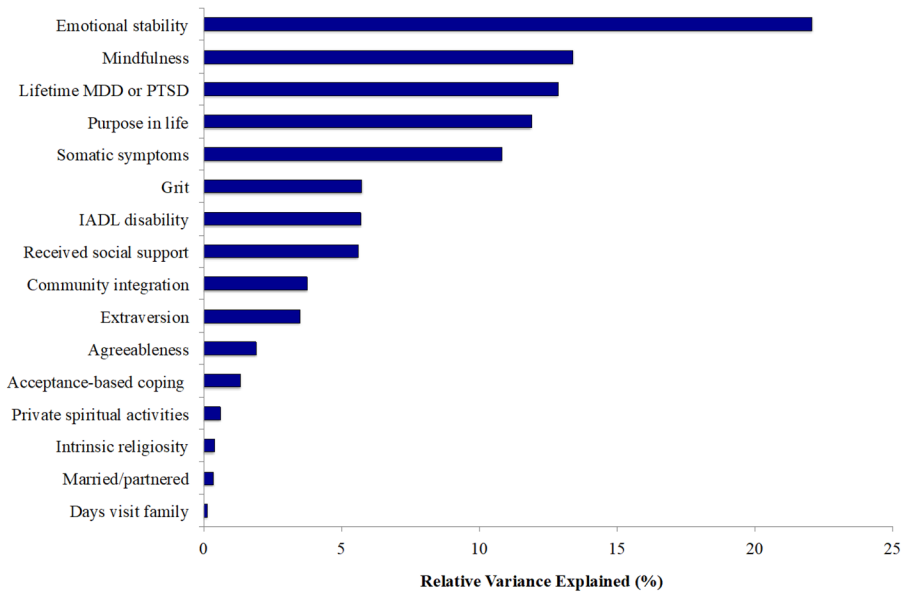
	N (weighted %) or weighted mean (SD)	Bivariate correlation with DBPR scores <i>r</i>	Multivariable association with DBPR scores ( $R^2 = 0.40$ ) $\beta$
<i>Social engagement</i>			
Number of days per week typically visit family [85]	1.8 (1.9)	0.04**	-0.04**
Number of days per week typically visit friends [85]	1.7 (1.6)	0.11***	0.01
<i>Altruistic activities</i>			
Engagement in volunteer activities on weekly basis [86]	1,624 (35.4%)	0.05***	0.02
Engagement in helping others with instrumental activities of daily living 10+times/year [86]	1,355 (31.9%)	0.00	—
<i>Religiosity/spirituality</i>			
Frequency of attending religious services [87]	2.8 (1.8)	0.05***	-0.04*
Frequency of private spiritual activities [87]	3.0 (2.1)	0.09***	0.09***
Intrinsic religiosity [87]	9.6 (4.1)	0.05**	-0.07***
<i>Physical health difficulties</i>			
Number of medical conditions	2.9 (2.2)	-0.14***	0.02
Any disability in activities of daily living [88]	212 (5.2%)	-0.17***	-0.01
Any disability in instrumental activities of daily living	549 (14.2%)	-0.25***	-0.08***
Somatic symptoms [89]	2.9 (3.2)	-0.35***	-0.09***
Physical exercise [90]	22.3 (34.7)	0.07***	0.02

$\beta$  = standardized coefficient; Statistically significant association: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$



Note. Higher scores reflect greater resilience; unit are standardized (z) scores.

**Fig. 1** Distribution of Standardized Discrepancy-Based Psychiatric Resilience (DBPR) Scores



Note. MDD=major depressive disorder; PTSD=postraumatic stress disorder; IADL=instrumental activities of daily living.

**Fig. 2** Relative Importance Analysis of Significant Correlates of DBPR Scores

## Discussion

Using data from a large, population-based sample of U.S. military veterans, we employed a discrepancy-based psychological resilience (DBPR) score approach to operationalize psychological resilience and identify sociodemographic, psychosocial, and health-related factors. Results revealed that several modifiable psychosocial factors, such as purpose in life, mindfulness, and grit, were associated with higher DBPR scores. Further, lifetime MDD or PTSD and physical health difficulties, such as IADL disability, were associated with lower DBPR scores. Collectively, these variables explained 40% of the variance in DBPR scores. Identification of these modifiable protective and risk factors for resilience could help inform targets for prevention and treatment efforts to bolster psychological adaptation to traumatic stress in veterans and other trauma-exposed populations.

Emotional stability was the strongest correlate of DBPR scores, accounting for 22.9% of the explained variance in these scores. In an independent sample of U.S. veterans [14], we similarly found that greater emotional stability was associated with greater resilience to PTSD symptoms specifically. Other work has similarly observed a link between high emotional stability and resilience [14, 30, 40, 41]. For example, a meta-analysis of 30 studies examining the relationship between the Big Five personality traits and resilience found negative correlations with neuroticism, suggesting that overall resilience included higher levels of emotional stability across multiple scales (i.e., 5 Personality Factor Questionnaire, Big Five Inventory, International Personality Item Pool) [42]. The authors suggested that key elements of resilience included a high level of self-control, motivation, positive emotions, social activity, and high levels of emotional stability or low levels of negative emotions [42]. While the cross-sectional design of this study does not allow us to disentangle temporal associations, greater emotional stability may represent a stable personality characteristic that may enable individuals to ‘bounce back’ from traumatic stress. Adaptive coping styles, such as positive reframing, seeking instrumental support, and planning, have also been found to mediate the relationship between personality traits, such as emotional stability, and post-traumatic psychological outcomes [41]. Alternatively, a previous history of psychiatric conditions linked to lower emotional stability [42], may render individuals more vulnerable to traumatic stressors. Further research that utilizes longitudinal study designs is needed to determine temporal associations between personality traits, such as emotional stability and resilience.

Mindfulness was the second strongest correlate of DBPR scores, accounting for 13.4% of the explained variance in these scores. A prior study of a population-based sample of U.S. veterans found that greater mindfulness partially mediated the relation between trauma exposure and adverse mental health outcomes such as PTSD symptoms and suicidal ideation [43]. Possible mechanisms by which greater mindfulness may lead to greater resilience include greater emotion regulation [43] and positive emotional states [44]. As such interventions shown to improve mindfulness may also improve psychological resilience. In line with this, several studies have shown that mindfulness-based stress reduction (MBSR) can promote personal resilience [45], reduce symptoms of depression and cognitive difficulties [46], and somatic symptoms [47, 48] and is successful in virtual formats.

Purpose in life was also one of the strongest correlates of DBPR scores, accounting for 11.9% of the explained variance in these scores. Purpose in life may enhance resilience through the promotion of other adaptive behaviors linked to resilience, such as physical activity and emotion regulation [49–51]. Together, these studies suggest that purpose in life is a key factor in reducing the risk of adverse health outcomes and increasing resilience. A

recent study of a nationally representative sample of older U.S. veterans found that higher purpose in life was associated with lower odds of several psychiatric conditions and suicidality. Fischer et al. [52] stated that purpose in life is a potential target area for transdiagnostic prevention and treatment for veterans' mental health. Several evidence-based clinical interventions have been developed, including acceptance and commitment therapy [53], logotherapy [54], reminiscence interventions [55], and dignity therapy for the end-of-life [56]. Further research is needed to evaluate whether these interventions could help promote resilience in veterans and other trauma-affected populations.

Somatic symptoms were another strong correlate of DBPR scores, accounting for 10.8% of the variance in these scores. In an independent sample of U.S. veterans [14], we similarly found that greater somatic symptoms were associated with lower resilience to PTSD symptoms specifically. Other studies have also identified links between somatic and PTSD symptoms [57–59]. Additionally, PTSD and related disorders such as MDD and GAD often co-occur with somatic disorders, and this association is likely bi-directional. Somatic symptoms are a core aspect of PTSD [59], and somatic symptoms after a traumatic exposure have been linked to the development of PTSD [60]. Conversely, prior work has found that PTSD symptoms may mediate the relation between trauma exposure and somatic symptoms [61]. Laboratory studies have found PTSD associated with an increased attentional bias towards threatening internal stimuli, which could heighten perceptions of somatic symptoms. PTSD may also co-occur with somatic symptoms, leading to physical and psychological 'mutual maintenance' of distress and lower resilience [62, 63].

Several other factors accounted for a small proportion of variance in DBPR scores. Grit accounted for 5.7% of the variation in DBPR scores. Previous literature has found grit to be correlated with greater self-efficacy and conscientiousness [64, 65], suggesting that individuals with higher levels of grit may have greater perseverance and self-reliance in their ability to manage their mental health [66]. IADL disability was negatively associated with resilience and accounted for 5.7% of the variance in DBPR scores. Several cross-sectional, nationally representative studies identified older age, psychiatric (e.g., PTSD or MDD), and medical conditions (e.g., diabetes or stroke) as key correlates of disability [67–69]. Results of the current study extend this work to suggest that IADL disability may be linked to lower resilience following trauma exposure. The current study also found that greater social support and community integration accounted for more than five percent of the variance in DBPR scores. Collectively, these findings and prior work observing associations between these variables and PTSD symptoms [70, 71] highlight the potential importance of interventions to promote grit, social support [72], and community integration [73] as part of resilience-promotion efforts. For example, a recent study used filmmaking as a therapeutic intervention as an effective tool to help promote community reintegration among veterans [74]. Further research is needed to evaluate whether targeting this, and other modifiable protective factors may help promote resilience in this population.

Limitations of this study must be noted. First, while nationally representative, the majority of veterans in this study were older, male, white, and non-combat veterans, which may limit the generalizability of the results. Second, self-report measures were used to assess trauma exposures and mental health rather than clinical interviews; thus, further research is required to see whether these findings can be replicated. Third, because the current study employed a cross-sectional design, it is not possible to assess whether temporal associations among variables. Fourth, the study relied largely on self-report psychosocial measures, and biological and environmental factors that may have been related to resilience was not assessed. Fifth, while we considered a large number of potential correlates of DBPR scores, the collective variance explained was moderate ( $R^2=0.40$ ). While this may

partly be attributable to the limited distribution of DBPR scores (Fig. 1), further research is needed to identify additional factors that may be linked to psychological resilience. Sixth, while the current study focused on psychological resilience, resilient outcomes are multi-dimensional and may extend to other life domains (e.g., functional resilience [75]). Further research is needed to identify the direct and interactive effects of a broader range of biological, environmental, and psychosocial factors in predicting resilience, as well as examining how these factors relate to resilience in different life domains.

Despite these limitations, the findings of the current study show the value of a DBPR score approach for operationalizing resilience to trauma and stress generally in a sample of U.S. military veterans that is nationally representative. Beyond psychiatric conditions (such as MDD, GAD, and PTSD), the DBPR approach to operationalizing resilience has application across combinations of traumatic exposure and stress while producing population-based expectancy scores for individuals in the population of interest. This method can measure stress from daily life on a spectrum of exposures, from high exposure/low distress (i.e., greater resilience) to low exposure/high distress (i.e., greater vulnerability). Although resilience is a complex construct that can be operationalized using an array of outcomes (e.g., psychological symptoms, functional impairment), this method might not adequately represent its multifaceted nature. Longitudinal analyses of resilience, mechanistic studies, and intervention studies targeting key risk and protective factors such as emotional stability, mindfulness, lifetime MDD or PTSD, purpose in life, and somatic symptoms—the strongest correlates of resilience in our study—could help promote and enhance resilience in veterans exposed to trauma and stress more broadly. Further research is needed to replicate these findings in veterans and other trauma survivors; examine longitudinal interrelationships among resilience-promoting factors; and evaluate the efficacy of interventions targeting modifiable factors in promoting resilience.

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## Declarations

**Competing Interest** None.

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**Michael F. Georgescu** Michael completed a Master of Public Health in the Social and Behavioral Sciences department at the Yale School of Public Health. He earned a BA in Psychology at Binghamton University in 2021. His current research interests include how violence, trauma, and PTSD alter long-term physical health and accelerate aging. He is also interested in neuro-cognitive aging and its associations with biological and psychosocial risk factors. His current research focuses on psychological resilience and trajectories of depressive symptoms in older adults using nationally representative samples. Michael is an intramural research training award recipient at the National Institute on Aging, collaborating on research projects that identify biomarkers, life periods, long-term exposures, and subclinical disease indicators that increase the risk of cognitive and physical function loss and disability.


**Ian C. Fischer** Ian is a postdoctoral fellow at the Yale School of Medicine.

**Sarah Lowe** Sarah Lowe, Ph.D., is a clinical psychologist and Associate Professor in the Department of Social and Behavioral Sciences at Yale School of Public Health, with secondary appointments in the Department of Psychiatry at Yale School of Medicine and Yale School of Nursing. Her research focuses on the long-term mental health consequences of a range of potentially traumatic events, as well as the impact of such events on other domains of functioning, such as physical health, social relationships, and economic wellbeing. Her work explores the mechanisms leading from trauma exposure to symptoms, and the role of

factors at various ecological levels – from genetics to neighborhoods – in shaping risk and resilience. She uses a range of methodologies to achieve her research aims, including structural equation modeling, latent growth curve analysis, geospatial modeling, and qualitative analysis, among others. Dr. Lowe received her Ph.D. from the University of Massachusetts Boston and completed a postdoctoral fellowship in the Psychiatric Epidemiology Training program at Columbia University Mailman School of Public Health.

**Robert H. Pietrzak** Robert H. Pietrzak completed a B.A. in Psychology at Clark University, and M.P.H. in Epidemiology and Ph.D. in Clinical Psychology with specialization in Clinical Neuropsychology at the University of Connecticut. Dr. Pietrzak is Director of the Translational Psychiatric Epidemiology Laboratory in the Clinical Neurosciences Division of the U.S. Department of Veterans Affairs National Center for PTSD and Professor of Psychiatry at Yale University School of Medicine and Professor of Public Health (Social and Behavioral Sciences) at Yale School of Public Health. His primary research interests include the psychosocial and genetic epidemiology of traumatic stress and resilience across the lifespan; dimensional models of stress-related psychopathology; and the effect of stress on cognition.

## Authors and Affiliations

Michael F. Georgescu<sup>1</sup>  · Ian C. Fischer<sup>2,3</sup> · Sarah Lowe<sup>1,2</sup> · Robert H. Pietrzak<sup>1,2,3</sup>

✉ Michael F. Georgescu  
michael.georgescu@yale.edu

<sup>1</sup> Department of Social and Behavioral Sciences, Yale School of Public Health, New Haven, CT, USA

<sup>2</sup> Department of Psychiatry, Yale School of Medicine, New Haven, CT, USA

<sup>3</sup> Department of Veterans Affairs National Center for Posttraumatic Stress Disorder, VA Connecticut Healthcare System, West Haven, CT, USA

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