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BASIC RESEARCH ARTICLE

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The association of resilience on psychiatric, substance use, and physical health outcomes in combat trauma-exposed military service members and veterans

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ABSTRACT

Objective: Although Combat exposure is associated with a range of psychiatric outcomes, many veterans do not develop psychopathology. Resilience is a multifaceted construct associated with reduced risk of distress and psychopathology; however, few studies have examined the relationship of resilience with a broader spectrum of health outcomes following combat exposure. It also remains important to determine the association of resilience above and beyond other documented risk and protective factors.

Method: In a sample of combat-exposed veterans (N = 1,046) deployed to Iraq and Afghanistan, we examined a quantitative method for exploring relative psychological resilience (discrepancy-based psychiatric resilience; DBPR) and tested the hypothesis that resilience would be associated with reduced risk for psychiatric diagnosis count, substance use, and physical health outcomes, above and beyond other known correlates (e.g. combat exposure, social support).

Results: In the final model, results suggested an inverse association of discrepancy-based psychiatric resilience with current psychiatric diagnosis count ($\beta = -0.57$, $p < .001$), alcohol use ($\beta = -0.16$, $p < .001$), drug use ($\beta = -0.13$, $p < .001$), and physical health concerns ($\beta = -0.42$, $p < .001$) after accounting for other relevant risk and protective factors.

Conclusions: Results extend the nomological net of this quantitative resilience construct to include other relevant health outcomes, and demonstrate that resilience may have more of a buffering relationship with psychiatric and physical health concerns compared to substance use outcomes.

La asociación de la resiliencia en las consecuencias psiquiátricas, consumo de sustancias y salud física en miembros del servicio militar y veteranos expuestos a trauma de combate

Objetivo: Aunque la exposición a combate se asocia con una serie de consecuencias psiquiátricas, muchos veteranos no desarrollan psicopatología. La resiliencia es un constructo multifacético asociado con riesgo reducido de estrés y psicopatología; sin embargo, pocos estudios han examinado la relación de la resiliencia con un espectro más amplio de resultados de salud después de la exposición al combate. También sigue siendo importante determinar la asociación de la resiliencia más allá de otros factores de riesgo y protectores documentados.

Método: En una muestra de veteranos expuestos a combate (N=1.046) desplegados en Iraq y Afganistán, examinamos un método cuantitativo para explorar la resiliencia psicológica relativa (resiliencia psiquiátrica basada en la discrepancia; DBPR en su sigla en inglés) y probó la hipótesis que la resiliencia se asociaría con un riesgo reducido para el recuento del diagnóstico psiquiátrico, uso de sustancias y resultados en salud física, más allá de otros correlatos conocidos (ej., exposición a combate, apoyo social).

Resultados: En el modelo final, los resultados sugirieron una asociación inversa de DBPR con el recuento del diagnóstico psiquiátrico actual ($\beta = -0.57$, $p < .001$), consumo de alcohol ($\beta = -0.16$, $p < .001$), consumo de drogas ($\beta = -0.13$, $p < .001$), y preocupaciones de salud física ($\beta = -0.42$, $p < .001$) después de considerar otros factores relevantes de riesgo y protectores.

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关键词
心理韧性; 退伍军人; 战争创伤; 物质使用; 身体健康

HIGHLIGHTS

- Examined the association of resilience with a spectrum of health outcomes following combat.
- Resilience had an independent effect on psychiatric diagnosis, alcohol and drug use, and physical health complaints over other important factors, such as social support.
- It was more strongly associated with psychiatric and physical health outcomes as compared to substance use.
- The impact of psychological resilience on development/perception of health-related complaints is important to consider regarding broad outcomes following trauma.

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Conclusiones: Los resultados extienden la red nomológica de este constructo cuantitativo de resiliencia para incluir otros resultados relevantes de salud y demostrar que la resiliencia podría tener una relación más amortiguadora con los problemas de salud física y psiquiátrica en comparación con los resultados de consumo de sustancias.

在战斗创伤的军人和退伍军人中，韧性和精神病、物质使用和身体健康结果的关联

目的：尽管战斗暴露与一系列精神病有关，但许多退伍军人并未发展出精神病理。韧性（resilience）是一种多方面的结构，可降低患病和精神病理学的风险；然而，很少有研究探讨了在战斗暴露后韧性与更广泛的健康结果之间的关系。确定韧性与其他风险和保护因素的关联仍然很重要。
方法：在派遣到伊拉克和阿富汗的战斗暴露退伍军人（N = 1046）的样本中，我们研究了一种探索相对心理韧性（基于差异的精神病韧性; DBPR）的定量方法，并检验了韧性与降低风险相关的假设用于精神病诊断计数，物质使用和身体健康结果，以及其他已知相关变量的关联（例如，战斗暴露，社会支持）。
结果：在最终模型中，结果表明在考虑其他相关风险和保护因素后，DBPR与当前精神病诊断计数（β = −0.57，p <.001），酒精使用（β = −0.16，p <.001），药物使用（β = −0.13，p <.001））和身体健康问题（β = −0.42，p <.001）呈负相关。
结论：结果扩展了该定量韧性结构的法则网，包括进了其他相关的健康结果，并证明了与物质使用结果相比，韧性可能对精神和身体健康问题有更多的缓冲关系。

Veterans represent a highly trauma-exposed population, inclusive of both combat and noncombat traumatic events (Dedert et al., 2009). Combat exposure, in particular, is associated with a high probability of a range of psychiatric conditions (Hoge, Auchterlonie, & Milliken, 2006), with the prevalence of screened or diagnosed mental health conditions in recently returning veterans ranging from 19% to 44% (e.g. Seal et al., 2009). Trauma exposure is a transdiagnostic risk factor, also increasing the likelihood of drug abuse symptoms (Kelley et al., 2015) and alcohol-related problems (Hahn, Tirabassi, Simons, & Simons, 2015). Combat exposure has been associated with increased suicide attempts and chronic pain diagnoses (Thomas, Harpaz-Rotem, Tsai, Southwick, & Pietrzak, 2017) as well as other functional impairments (e.g. relationship difficulties; Thomas et al., 2010).

Despite the high prevalence of trauma exposure and associated negative outcomes, the majority of returning veterans do not report significant psychological distress, but instead, exhibit what can be considered 'resilient' responses. Resilience broadly implies relative resistance to distress and disturbance from adverse life experiences (Luthar, Cicchetti, & Becker, 2000) or evidencing a better outcome than others exposed to the same risk (Rutter, 2006). It is often measured as an outcome, such as the lack of general distress (Bonanno et al., 2012) or of specific diagnoses (e.g. posttraumatic stress disorder [PTSD]; Maguen et al., 2008), or as a trait (e.g. the Connor-Davidson Resilience Scale [CD-RISC]; Connor & Davidson, 2003). Resilience has received increased attention in returning veterans (e.g. Green, Calhoun, Dennis, & Beckham, 2010; Pietrzak et al., 2010; Zimmerman et al., 2014); however, this construct remains in need of further investigation in military populations, given the potency of combat experiences and the broad effects deployment and reintegration post-deployment have on service members' support networks.

It is being increasingly recognized that resilience in some domains does not signify adaptation across all functional domains and outcomes (Southwick, Bonanno, Masten, Panter-Brick, & Yehuda, 2014). As Masten (2015) has argued, regardless of how resilience is defined, it should be examined in association with multiple domains of functioning. Thus, it is important to understand the association of a given resilience conceptualization across domains beyond psychiatric functioning, yet an examination of how or whether resilience is related to wider outcomes remains limited. Previous work among U.S. military veterans and service members demonstrated that self-reported resilience, measured by the CD-RISC, was associated with alcohol use and health conditions (Green et al., 2010) after controlling for demographic factors, trauma exposure, and PTSD status. Other work has demonstrated resilience is a useful predictor of psychiatric outcomes beyond other robust protective factors, such as social support (e.g. Brancu et al., 2014; Pietrzak et al., 2010). Continued investigation of post-trauma outcomes, using various markers of resilience, is warranted.

In this paper, we used a methodology for exploring relative psychological resilience given identified risk factors, termed by our research group as the 'discrepancy-based psychiatric resilience model' (Amstadter, Myers, & Kendler, 2014). This measure of resilience uses trauma load (defined as the number of lifetime traumatic event categories endorsed) and a broad measure of internalizing symptoms to determine a spectrum of individual responding in either direction (i.e. reporting more or less psychiatric distress than expected given trauma load) to capture a continuum of responding. This discrepancy-based psychiatric resilience measure, referred to hereafter as DBPR,

has been examined in behavioural genetic (Amstadter, Moscati, Maes, Meyers, & Kendler, 2016), epidemiologic (Sheerin et al., 2018a), and combat-specific (Sheerin, Stratton, Amstadter, MIRECC workgroup, & McDonald, 2018b) samples, and has been previously demonstrated to protect against development of later internalizing disorders, even in the context of new-onset stressors (Sheerin et al., 2018a). DBPR has a modest correlation with the CD-RISC (Sheerin et al., 2018b), suggesting, as one would expect, these two measurements of resilience are meaningfully related yet are not tapping into a unitary construct. A remaining question is whether this index of resilience is useful when expanded to the examination of its association with other outcomes, above and beyond other known predictors. The goal of this study was to extend this work by exploring the association of the DBPR, above and beyond other statistically significant predictors, with multiple health outcomes: current psychiatric disorder diagnosis count, alcohol and drug use, and physical health complaints in a large sample of combat-exposed service members and veterans. A path analytic framework was chosen to simultaneously include multiple, correlated predictors in the prediction of multiple, correlated outcomes. It was hypothesized that DBPR would be associated with all outcomes above and beyond other predictors.

1. Method

1.1. Participants and procedures

The sample was selected from U.S. military service members and veterans who participated in the Department of Veterans Affairs (VA) Mid-Atlantic Mental Illness Research, Education and Clinical Center (MIRECC) multi-site Post-Deployment Mental Health study (PDMH; Brancu et al., 2017). Inclusion criteria for the overarching PDMH study included serving in the US military and/or reserve forces on or after 11 September 2001. Exclusion criteria included primary language other than English, difficulty comprehending the consent process, and the inability to travel to one of the participating data-collection sites. The present study represents the combat trauma-exposed subsample (n = 1,046) within the larger PDMH study (n = 2,546 at time of data freeze). Participants were excluded from the present study if they did not report lifetime combat trauma exposure. Participant demographic characteristics are presented in Table 1. Informed consent and data collection were completed at one of four VA medical centres; institutional review boards at each site approved the study. Participants completed a semi-structured diagnostic interview and a battery of self-report questionnaires addressing a range of post-deployment experiences including health, psychiatric symptoms, health-related behaviours (e.g. alcohol and drug use), and psychosocial factors. Combat exposure for study inclusion was determined based on the endorsement on self-report measures. It is noted that although advertised broadly, the sample is volunteer-based and approximately half of the broader study reported receiving outpatient mental health treatment (Brancu et al., 2017), resulting in generally higher rates of psychiatric conditions in this sample as compared to other general military and veteran samples (Frayne et al., 2011; Hoge et al., 2006), but in line with studies of treatment-seeking military personnel (Vyas et al., 2016).

1.2. Study outcome variables

1.2.1. Psychiatric disorder diagnosis count

All participants were assessed with the Structured Clinical Interview for DSM-IV-TR Axis I Disorders: Patient Edition (SCID I/P, Version 2.0; First, Spitzer, Gibbon, & Williams, 1994) administered by experienced raters who underwent training and participated in bi-weekly peer consultation reliability meetings. The reliability of interviewers on scoring a series training videos was excellent (Fleiss' kappa = 0.94). As the study began in 2005, the DSM-IV version was retained to maintain consistency in evaluation methods. The PTSD module was assessed for the 'worst' traumatic event endorsed, and thus, is not necessarily a deployment-related event. For the current study, a count variable was created for each current (i.e. past 12 months) internalizing psychiatric disorder diagnosis (major depressive disorder, bipolar disorder I and II, depressive disorder NOS, generalized anxiety disorder, panic disorder with and without agoraphobia, PTSD, social anxiety disorder, obsessive-compulsive disorder, phobia, anxiety disorder NOS; possible range = 0–12, actual range = 0–5).

1.2.2. Alcohol use symptoms

Participants completed the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993), a 10-item self-report questionnaire used to identify individuals with harmful and hazardous patterns of alcohol consumption as well as dependence. Items are on a Likert scale, from 0 to 4. The measure showed good internal consistency in the main study (Chronbach's alpha of .86). A continuous sum score (range 0–40) was used in the present study, with higher scores indicating a greater likelihood of hazardous and harmful drinking (11.7% above the ≥8 cut-off threshold in this sample).

1.2.3. Drug use symptoms

Participants completed the Drug Abuse Screening Test (DAST-20; Gavin, Ross, & Skinner, 1989), a 20-item self-report questionnaire developed as a clinical screen to identify the type and frequency of illicit

Table 1. Descriptive characteristics of the sample (N = 1046) and main predictor and outcome variables.

Demographic Variables	N/Mean	%/SD
Age	36.2	9.86
Gender		
Male	920	88.0
Female	126	12.0
Ethnicity		
White/Caucasian	580	55.4
African American	460	44.0
Marital Status		
Married/Partnered	572	54.7
Divorced/Separated	244	23.3
Never Married	226	21.6
Widowed	3	.3
Education		
GED	53	5.4
High School	431	41.2
Technical/Trade School	101	9.7
Associate's Degree	174	16.6
Bachelor Degree	167	16.0
Master Degree	50	4.8
Doctorate Degree	7	.7
Other	63	6.0
Military Related Variables		
Active Duty	87	8.3
Rank		
E-1 to E-4	338	32.5
E-5 to E-7	569	54.7
E-8 to E-9	59	5.7
W-1 to W-5	17	1.6
O-1 to O-9	58	5.6
Tours Served	1.63	1.13
Study Predictor Variables		
Combat Exposure	18.68	9.02
Social Support	70.42	26.74
Resilience*	590	56.4
GSI items		
GSI raw score**	1.16	.88
GSI t-score	50.0	10.0
Above cut-off threshold ≥ 63	133	12.7
TLEQ events endorsed	7.31	3.57
TLEQ items (top 5)		
Natural disaster	703	67.3
Sudden death of loved one	835	79.9
Life threat to loved one	426	40.8
Threatened with death or harm	400	38.3
Other life threatening/distressing event	578	55.3
Study Outcome Variables		
Current Psychiatric Diagnosis	721	68.9
Count of Psychiatric Diagnoses	1.05	0.91
Primary diagnostic categories		
Posttraumatic stress disorder	623	59.6
Major depressive disorder	300	28.7
Alcohol abuse/dependence	89	8.5
Panic disorder	33	3.2
Social anxiety disorder	36	3.4
Illicit drug abuse/dependence	28	2.7
AUDIT total	5.91	6.67
Above cut-off threshold ≥ 8	122	11.7
DAST total	1.58	2.85
Above cut-off threshold ≤ 6	84	8.0
Physical Health Complaints	4.93	4.28

*As resilience represents the standardized residuals from a regression, the mean is 0. A dichotomous yes/no resilience status is presented here only for descriptive purposes, wherein a positive residual (after multiplying by −1) was deemed resilient. The continuous measure is used in the study analyses, with a range of is −3.17–2. Measures comprising the resilience variable are included as well. ** the GSI T score, not the raw score, was used in creation of the resilience variable, which has a mean of 50 and SD of 10.

Abbreviations: TLEQ = Traumatic Life Events Questionnaire, using the event sum of endorsed traumatic events resulting in intense fear, helplessness, or hopelessness; SLC GSI = General severity index of the Symptom Check List-90; AUDIT = Alcohol Use Disorders Identification Test; DAST = Drug Abuse Screening Test.

drug use. Responses on this item are scored as a dichotomous yes/no. Cronbach's alpha coefficient in the main study was .83. A continuous sum score of 'yes' endorsement (range 0–20) was used in the present study, with higher scores indicating greater problems related to substance misuse (8.0% above the ≥6 cut-off threshold in this sample).

1.2.4. Physical health complaints

The National Vietnam Veterans Readjustment Study Self-Reported Medical Questionnaire (NVVRS; Kulka et al., 1990) was used to assess self-reported health complaints and problems. Participants were presented with a dichotomous yes/no rating list, where they indicated whether they currently had any of a 22-item list of physical symptoms (e.g. headaches, nausea, muscle aches). This was summed to create a total current health complaints score, as used in previous work (Green et al., 2010).

1.3. Study predictor variables

1.3.1. Demographics

A self-report demographic questionnaire was developed specifically for the PDMH Study. This instrument assessed characteristics used in the present analyses, including age, gender, marital status, race/ethnicity, education, military history, and employment.

1.3.2. Social support

Participants completed the Medical Outcomes Study Social Support Survey (MOS; Sherbourne & Stewart, 1991), a 19-item, multidimensional self-administered survey of perceived social support designed to assess four functional support dimensions (emotional/informational, tangible, affectionate, and positive social interaction). Individuals reported the frequency with which each type of support is available, ranging from 0 (none of the time) to 4 (all of the time). The measure provides an overall functional support index, determined by summing all items divided by the maximum possible (Cronbach's alpha = .98).

1.3.3. Combat exposure

Participants completed the 7-item Combat Exposure Scale (CES; Keane et al., 1989), a self-report measure that assessed how frequently combat-related experiences (e.g. being under enemy fire) occurred, rated on a frequency scale (0 = none; 1 = 1–3 times; 2 = 4–12 times; 3 = 13–50 times; 4 = 51+ times). A total score was calculated using weighted scores (Cronbach's alpha = .82). While combat trauma is included within the DBPR variable, the CES was also included as an independent predictor as it provides more information on the frequency of combat exposure (as compared to any exposure) and is frequently associated with these outcomes in the literature.

1.3.4. DBPR; resilience variable

The resilience variable in the present study utilized two separate measures: the Traumatic Life Events Questionnaire (TLEQ; Kubany et al., 2000) and the Symptom Checklist-90 Item-Revised (SCL-90-R; Derogatis, 1992). The TLEQ lists 23 different traumatic events (DSM-IV criterion A for PTSD). Each of the 23 categories is rated for lifetime number of occurrences. These responses were summed to produce a count of each trauma event category endorsed, where the respondent experienced fear, helplessness, or horror, that occurred one or more times. The SCL-90-R lists 90 psychological and somatic symptoms. Items are rated for past-week severity on a scale of 0 (not at all) to 4 (extremely). The scale yields a total Global Severity Index (GSI), an index that provides a measure of overall psychological distress.

The DBPR was created by linearly regressing GSI T-scores from the SCL-90 (the outcome) onto the number of traumatic event types endorsed from the TLEQ (predictor). This regression resulted in a significant model ($p < .001$) with TLEQ B = 1.10, constant B = 44.16, and $R^2 = .20$. The standardized residuals from this regression are saved. As done in prior analyses (e.g. Amstadter et al., 2016; Sheerin et al., 2018b; Sheerin et al., 2018a) the residuals from this regression were multiplied by −1 for ease of interpretation. Greater, positive residuals represent an individual whose level of distress is 'better than expected' (i.e. their degree of 'resilience') whereas a negative residual is reflective of the degree of 'non-resilience.'

2. Data analytic plan

To test the study aims, path analyses were conducted in Mplus Version 8 (Muthén & Muthén, 2017) to examine a hypothesized pattern of relations among predictors onto the four outcomes: current psychiatric diagnosis count, AUDIT total, DAST total, and physical health complaints. Predictors were allowed to co-vary in the models. Missing data on endogenous variables were estimated as a function of the observed exogenous variables under the missingness at random assumption (Schafer & Graham, 2002). Data were missing on four predictor variables, at less than 1% (race, n = 6; education, n = 11; combat exposure, n = 4), with the exception of social support, which was missing in 20% of the sample (n = 216). Individuals with missing data on predictors were not omitted from analyses. Analyses were assessed for the goodness of fit using Comparative Fit Index (CFI) ≥ .95 and Root Mean Square Error of Approximation (RMSEA) ≤ .08 (Hu & Bentler, 1999). The maximum likelihood estimator (MLR) in Mplus, recommended with continuous outcomes and robust to non-normality of variables, was utilized (see www.statmodel.com/discussion/messages/11/657.html?1342887417).

The initial model was built based on significant bivariate correlations. Resilience was not initially included due to our aim to determine the association of resilience on our outcomes above and beyond significant covariates. Model trimming was then conducted by removing all non-significant paths. Finally, DBPR was added to this model. Prior to model testing, the distributional properties of the study variables were examined. With a few exceptions, study variables were within appropriate skew (±2) and kurtosis (±7) limits (West, Finch, & Curran, 1995). Of note, DAST scores were skewed (3.14) and highly kurtotic (11.54). Thus, prior to conducting primary analyses, it was log transformed, which improved both skew (0.32) and kurtosis (−1.42).

3. Results

3.1. Preliminary analyses and descriptives

Descriptive statistics for the sample and predictor and outcome variables are presented in Table 1. Correlations for the study variables are reported in Table 2. Demographic variables were variably correlated with all four outcomes, while combat exposure, social support, and DBPR were all significantly correlated with the four outcomes.

3.2. Model testing

The trimmed model with significant covariates prior to the inclusion of DBPR (i.e. Model 2) provided a good fit to the data (CFI = 0.991; RMSEA = 0.023). Results of this model are presented in Table 3. Social support was inversely associated with all four outcomes (psychiatric disorder diagnosis count, AUDIT total, DAST total, and physical health complaints). Combat exposure was positively associated with all outcomes. Demographic variables were inconsistently associated across outcomes, such that male gender was associated with both substance use outcomes while female gender was associated with psychiatric and physical health outcomes. Age predicted alcohol use and drug use such that older individuals reported less use. Race, education, and marital status were generally not associated with study outcomes, with the following exceptions: greater education was protective against psychiatric disorder diagnosis and drug use, being married was protective against physical health complaints, and racial minority status was associated with fewer psychiatric diagnoses but more health complaints.

Next, the resilience variable was added to the model to test its association with each outcome variable above and beyond the covariates. This model also provided a good fit to the data (CFI = 0.987; RMSEA = 0.037). Results of the final model (Table 3, Model 3) indicated that resilience was significantly

Table 2. Correlations of study variables of interest (N = 1046).

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Age at visit	–											
2. Gender[a]	−.02	–										
3. Race[b]	.22**	.12**	–									
4. Education[c]	.23**	.15**	−.001	–								
5. Marital Status[d]	−.28**	.19**	.06	−.08*	–							
6. CES	−.20**	−.16**	−.20**	−.10**	.04	–						
7. MOS	−.01	.001	−.09*	.07*	−.27**	−.09**	–					
8. DBPR	.09**	−.05	−.04	.15**	.01	−.17**	.31**	–				
9. Psychiatric Dx[e]	−.03	.10**	.05	−.14**	.06	.20**	−.29**	−.55**	–			
10. AUDIT	−.22**	−.14**	−.08*	−.11**	.12**	.18**	−.13**	−.21**	.15**	–		
11. DAST	−.18**	−.04*	.02	−.16**	.14**	.10**	−.12**	−.17**	.19**	.38**	–	
12. NVVRS Health	.02	.11**	−.08*	.01	−.07*	.18**	−.18**	−.46**	.41**	.08**	.12**	–

* = $p < .05$; ** = $p < .01$; correlations created specifying dichotomous and continuous variables; a = Reference, males (= 0, females = 1); b = Reference, Caucasian (= 0, African American and Other = 1); c = Education was treated as an ordinal variable with 1 = G.E.D., 2 = High School Diploma, 3 = Technical/Trade school, 4 = Associate degree, 5 = Bachelor degree, 6 = Master degree, 7 = Doctoral degree, the 'other' option was considered missing in analyses as level/nature of education is unknown; d = Marital status, reference is married vs. divorced/separated/widowed or never married; e = Psychiatric Dx; sum count of current diagnosis of internalizing Axis 1 conditions by DSM-IV.

Abbreviations: CES = Combat Exposure Scale; MOS = Social Support Scale; Resilience = discrepancy-based resilience determination; AUDIT = Alcohol Use Disorders Identification Test; DAST = Drug Abuse Screening Test; NVVRS Health = National Vietnam Veteran Readjustment Study Self-Reported Medical Questionnaire.

Table 3. Model predicting sum of psychiatric diagnoses, alcohol abuse symptoms, drug abuse symptoms, and physical health complaints from several predictors without resilience and model predicting these outcomes with resilience included (N = 1046).

	Psychiatric Diagnosis		AUDIT total		DAST total		Physical Health Complaints	
Predictors	β	SE B	β	SE B	β	SE B	β	SE B
Model 1: Initial Model, all variables								
Age	0.01	0.02	−0.18***	0.10	−0.17***	0.03	0.04	0.08
Gender	0.15***	0.09	−0.13***	0.54	−0.08*	0.16	0.18***	0.46
Race	0.05	0.06	−0.01	0.42	0.04	0.11	−0.09**	0.28
Education	−0.14***	0.02	−0.02	0.14	−0.08*	0.04	−0.01	0.10
Marital Status	−0.06	0.06	0.06	0.44	0.02	0.11	−0.14***	0.29
Combat Exposure	0.20***	0.02	0.11***	0.12	0.08*	0.03	0.19***	0.08
Social Support	−0.28***	0.02	−0.12**	0.13	−0.13***	0.03	−0.20***	0.09
Model 2: Trimmed, without resilience								
Age	–		−0.20***	0.09	−0.18***	0.03	–	
Gender	0.14***	0.09	−0.12***	0.52	−0.07*	0.15	0.18***	0.46
Race	–		–		–		−0.10**	0.25
Education	−0.13***	0.02	–		−0.08*	0.03	–	
Marital Status	–		–		–		−0.13***	0.26
Combat Exposure	0.19***	0.02	0.11***	0.12	0.07* 0.03		0.18***	0.08
Social Support	−0.27***	0.02	−0.14***	0.13	−0.14***	0.03	−0.20***	0.09
Model 3: Trimmed, with resilience								
Age	–		−0.19***	0.09	−0.18***	0.03	–	
Gender	0.10***	0.07	−0.13***	0.51	−0.08**	0.15	0.15***	0.43
Race	–		–		–		−0.11**	0.24
Education	−0.08**	0.16	–		−0.07*	0.03	–	
Marital Status	–		–		–		−0.11***	0.25
Combat Exposure	0.12***	0.01	0.09**	0.11	0.05 0.03		0.12***	0.07
Social Support	−0.14***	0.02	−0.09*	0.14	−0.11**	0.03	−0.07^{+}	0.09
Resilience	−0.47***	0.03	−0.16***	0.23	−0.13***	0.06	−0.42***	0.15

*** = p < .001, ** = p < .01, * = p < .05; $^{+}$ = p = .054; Psychiatric diagnosis = count of presence of any current Axis I disorder excluding substance use disorders; Alcohol Use = AUDIT; Drug Use = DAST, log transformed; Physical Health Complaints = NVVRS Medical Questionnaire, Part 1, section 2 (current, general health complaints); Gender (male = 0, female = 1); Race (Caucasian = 0, African American and Other = 1); Education was treated as an ordinal variable with 1 = G.E.D., 2 = High School Diploma, 3 = Technical/Trade school, 4 = Associate degree, 5 = Bachelor degree, 6 = Master degree, 7 = Doctoral degree; Marital status (married = 0, divorced/separated/widowed/never married = 1).

associated with all four outcomes, above and beyond other significant predictors. Specifically, greater resilience was associated with a lower risk of internalizing psychiatric disorder diagnosis count, lower AUDIT and DAST scores, and fewer physical health complaints.

Of the associations that were significant in the earlier model, all retained significance when resilience was added to the model with two exceptions: the association between combat exposure and DAST scores became non-significant and the effect of social support on health outcomes became marginal ($p = .054$). Prior to adding resilience, the model explained 15%, 10%, 8%, and 10% of the variance of psychiatric disorder diagnosis count, AUDIT total, DAST total, and physical health complaints, respectively. The addition of resilience resulted in greater variance explained in all four outcomes: psychiatric disorder diagnosis count, R^2 = 34% (ΔR^2 = 19%); AUDIT total R^2 = 12% (ΔR^2 = 2%); DAST total R^2 = 10% (ΔR^2 = 2%); physical health complaints R^2 = 26% (ΔR^2 = 16%).

Several follow-up analyses were conducted. First, to confirm the association with any psychiatric diagnosis was not driven solely by PTSD, a follow-up

analysis was conducted using an alternative variable, any current diagnosis, excluding PTSD (decreasing positive endorsement from 69% to 40%). Results followed the same pattern. The same pattern was also found when examining the presence or absence of current PTSD only (59.6% of sample). This suggests the association of resilience on psychiatric outcomes is relevant to internalizing disorders separate from PTSD as well as when examining a specific, trauma-related psychiatric outcome.

4. Discussion

The primary goal of this study was to expand the nomological network of resilience to include post-trauma functional outcomes in a sample of deployed post-9/11 veterans by determining the strength of association of an emerging measure of resilience, discrepancy-based psychiatric resilience (DBPR) with health outcomes beyond psychiatric disorders. A strength of the analytic strategy is that it allowed for examination of the effects of resilience on each outcome over and above covariates with which it may be correlated, while accounting for its effects on correlated outcomes. In so doing, we are also able to comment on the unique associations among study predictors and outcomes. As hypothesized, DBPR was associated with all outcomes (i.e. internalizing psychiatric disorder diagnosis count, AUDIT and DAST total scores, and physical health complaints), above and beyond covariates of combat exposure and social support. Further, the change in predicted variance associated with resilience was greater for outcomes of psychiatric disorders and physical health complaints than alcohol and drug use, suggesting that DBPR may be a more relevant predictor for those outcomes.

Results are consistent with work that evaluated resilience as a trait-based predictor (e.g. CD-RISC; Green et al., 2010) and expand on this work. That is, rather than using participants' self-report of resilience as a perceived collection of traits, this project conceptualized resilience as reported distress as a function of trauma load, relative to others within the sample. Resilience conceptualized in this way offers a potentially more objective measure of resilient responding and adds to the prediction of functional outcomes above and beyond both unmodifiable (i.e. combat exposure) and malleable (i.e. social support) correlates, lending support to the findings of Green et al. (2010) that resilience offers a prediction value on its own.

Study findings have several implications. First, individuals with higher resilience may be less likely to have a current internalizing psychiatric diagnosis than those with lower resilience, suggesting the utility of examining various resilience measures with regard to broad psychiatric outcomes, not simply PTSD. Further, in the broader landscape of prediction of post-deployment psychiatric health, resilience may have a statistically significant, yet modest, effect, suggesting the importance of other variables (e.g. genetic risk, level of exposure, social support). For example, prospective work has found that although self-assessed resilience pre-deployment was associated with decreased incidence of emotional disorder after deployment, the predictive effect was modest (Cambell-Sills et al., 2018).

Second, results support the hypothesis that DBPR was associated with reduced reporting of physical health complaints, separate from the effects on mental health outcomes, consistent with Green et al.'s (2010) findings using the CD-RISC. Thus, one's psychological resilience may impact one's development or perception of health-related complaints. Research has suggested that trauma exposure and PTSD have negative consequences on health concerns (e.g. El-Gabalawy, Blaney, Tsai, Sumner, & Pietrzak, 2018). Physical and mental health comorbidities, such as PTSD and pain, can complicate assessment and treatment and are associated with increased health-care utilization (e.g. Thomas et al., 2017). Despite this, the associations between resilience and physical health complaints are not frequently studied in veterans. Psychological resilience should be examined with regard to physical health following trauma, as it may serve as an important risk marker for the exacerbated emotional difficulty and may identify individuals at risk of reduction of quality of life and general wellness in response to trauma.

Third, the results of the present study indicate that DBPR is associated with decreased risk of alcohol and drug use, both of which are frequently problematic in combat-exposed veterans (Fuehrlein et al., 2016). However, effects were smaller as compared to those for psychiatric and physical health conditions. It appears that this finding is not unique, with existing work in veterans demonstrating that although significant, CD-RISC scores explained the smallest amount of variance on AUDIT scores compared to depression and health conditions (Green et al., 2010) and other work that found CD-RISC scores were associated with depression but not alcohol use in emerging adults (Goldstein, Faulkner, & Wekerle, 2013). Varying measures of resilience appear to better tap into internalizing conditions compared to substance use conditions, suggesting other unknown factors may be at play and further investigation is needed regarding protective factors against substance use conditions.

Finally, there is great interest in the potential for interventions aimed at improving resilience in service members and veterans (e.g. US Army's Master Resilience Training [MRT]; Reivich, Seligman, & McBride, 2011). While the present study examined

outcomes years after deployment and after they have developed, targeting resilient coping may be even more effective as a more immediate post-deployment prevention intervention to boost resilience shortly after deployment and to decrease the development of negative outcomes. This early and proactive outreach targeting at-risk groups has become more of a focus following disaster- and terror-related traumatic events (Dyb, Jensen, Glad, Nygaard, & Thoresen, 2014; Reifels et al., 2013). The DBPR approach of comparing relative distress in relation to trauma history may be used in the future as a way of identifying individuals demonstrating greater distress in comparison to others with similar trauma history, and in turn, target interventions to them specifically.

Findings of the current study should be considered in the context of limitations. The recruitment of a regional, voluntary sample, which included primarily treatment-seeking participants, may limit generalizability of the results to the broader Veteran population (although the sample is representative of those likely to be presenting for treatment, in that 67.7% had at least one psychiatric diagnosis; Vyas et al., 2016) and should be kept in mind when interpreting predictors of resilience in this population. Although a strength of this study is its extension of previous findings within the same sample using an alternative measure of resilience, there are limitations to the measurement of DBPR. Our use of total trauma load in the determination of DBPR is susceptible to recall bias and does not account for the severity of events. Additionally, given the use of GSI in the creation of the DBPR variable, DBPR may reflect the global severity of distress that is common in psychiatric disorders, and the cross-sectional nature of the study cannot definitively determine that results are not driven, in part, by the association between the outcomes themselves and symptoms. However, a unique aspect of the DBPR is its accounting for trauma load. Although lifetime trauma exposure was used in the calculation of DBPR and current mental health diagnoses were used within the analytic models, pre-trauma, chronic mental health conditions were not evaluated and may potentially act as an unmeasured confound. Another limitation is that while the DBPR method has been used in previous publications, fit and descriptive information has not been presented, preventing the ability to compare across studies and determine the generalizability of the DBPR method. Further, we attempted to include functional and health-related outcomes associated with resilience but were limited by pre-existing measures. Assessment of additional domains, such as chronic pain and quality of life, is needed. Current life stressors further contribute to risk for negative outcomes following traumatic events (Cone et al., 2015), but were not measured in the parent study. Inclusion of current stressors as either a covariate or as part of the determination of resilience would be useful in future investigations. Lastly, given the methodological approach to creating the DBPR, the resilience determination is dependent on sample subjects. This highlights the importance of considering the context when defining resilience.

Despite these limitations, the strengths of this study include the use of an emerging, non-self-report measure of resilience and controls for combat exposure and social support, which are established risk and protective factors post-trauma. A potential strength of this quantitative approach is that it is based on the difference between actual and predicted distress, as compared to one's perception of coping ability, possibly reducing reporter bias. Another potential benefit is that this method allows resilience to be calculated in various datasets that may not have a measure of perceived resilience. Results lend further support to the importance of considering resilience as a protective factor and a target for treatment, and ideally prevention, to improve a variety of post-trauma outcomes. Useful further research may be directed toward evaluating whether interventions to increase resilience are associated with changes in broader outcomes, such as veterans' physical health concerns and substance use.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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