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Experiential Avoidance is Associated with Medical and Mental Health Diagnoses in a National Sample of Deployed Gulf War Veterans

Shannon M. Blakey[a,b], **Tate F. Halverson**[a], **Mariah K. Evans**[c], **Tapan A. Patel**[a], **Lauren P. Hair**[a,c], **Eric C. Meyer**[d], **Bryann B. DeBeer**[e,f], **Jean C. Beckham**[a,b,c], **Mary J. Pugh**[g,h], **Patrick S. Calhoun**[a,b,c], **Nathan A. Kimbrel**[a,b,c]

[a]Durham VA Health Care System, 508 Fulton Street, Durham, NC 27705 USA

[b]VA Mid-Atlantic Mental Illness Research, Education and Clinical Center, 3022 Croasdaile Dr., Durham, NC 27705 USA

[c]Duke University School of Medicine Department of Psychiatry and Behavioral Sciences, Duke University School of Medicine, DUMC 3625, Durham, NC 27710 USA

[d]University of Pittsburgh Department of Rehabilitation Science and Technology, 4028 Forbes Tower, Pittsburgh, PA 15260 USA

[e]VA Rocky Mountain Mental Illness, Research, Education, and Clinical Center, 1700 N Wheeling St, G-3-116M, Aurora, CO 80045 USA

[f]Department of Physical Medicine and Rehabilitation, Anschutz Medical Campus, University of Colorado, 12631 E 17th Ave, Aurora, CO 80045 USA

[g]VA Salt Lake City Healthcare System, 500 Foothill Dr, Salt Lake City, UT 84148 USA

[h]University of Utah School of Medicine Department of Medicine, 30 N. 1900 E, Salt Lake City, Utah 84132 USA

Abstract

A substantial minority of deployed Gulf War veterans developed posttraumatic stress disorder (PTSD), depression, and several chronic illnesses. Although military combat and exposure to certain nuclear, biological, and chemical agents (NBCs) increase risk for post-deployment health problems, they do not fully explain many Gulf War veteran health diagnoses and are not viable

Shannon M. Blakey: Shannon.Blakey@va.gov.

CRediT Author Statement

Shannon M. Blakey: Conceptualization; Formal analysis; Writing – Original draft; Visualization
Tate F. Halverson: Conceptualization; Formal analysis; Writing – Review & editing; Visualization
Mariah K. Evans: Writing – Original draft; Writing – Review & editing
Tapan A. Patel: Writing – Review & editing
Lauren P. Hair: Project administration; Writing – Original draft; Writing – Review & editing
Eric C. Meyer: Writing – Review & editing
Bryann B. DeBeer: Writing – Review & editing
Jean C. Beckham: Supervision; Resources; Writing – Review & editing
Mary J. Pugh: Funding acquisition; Writing – Review & editing
Patrick S. Calhoun: Conceptualization; Formal analysis; Writing – Review & editing; Supervision
Nathan A. Kimbrel: Conceptualization; Funding acquisition; Writing – Review & editing; Supervision

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treatment targets. Experiential avoidance (EA; one's unwillingness to remain in contact with unpleasant internal experiences) is a modifiable psychosocial risk factor associated with PTSD and depression in veterans as well as pain and gastrointestinal diseases in the general population. In this study, we recruited a national sample of deployed Gulf War veterans ($N = 454$) to test the hypothesis that greater EA would be significantly associated with higher lifetime odds of PTSD, depression, "Gulf War Illness" (GWI/CMI), and other chronic illnesses common in this veteran cohort. Participants completed a self-report battery assessing demographic, military-related, and health-related information. Multivariate analyses showed that after adjusting for age, sex, race, combat exposure, and NBC exposure, worse EA was associated with higher lifetime odds of PTSD, depression, GWI/CMI, gastrointestinal problems, irritable bowel syndrome, arthritis, fibromyalgia, and chronic fatigue syndrome (ORs ranged 1.25 to 2.89; effect sizes ranged small to large), but not asthma or chronic obstructive pulmonary disease. Our findings suggest medical and mental health providers alike should assess for EA and potentially target EA as part of a comprehensive, biopsychosocial approach to improving Gulf War veterans' health and wellbeing. Study limitations and future research directions are also discussed.

Keywords

Experiential avoidance; Gulf War; veterans; chronic illness; PTSD; depression

Between 1990 and 1991, the United States (U.S.) military participated in Operation Desert Shield, Operation Desert Storm, and Operation Desert Sabre—collectively called the Gulf War or Persian Gulf War. Following Gulf War operations, veterans from the U.S. and other coalition nations reported a wide array of persistent and disabling symptoms including fatigue, musculoskeletal pain, respiratory difficulties, and gastrointestinal complaints (Dursa et al., 2020; Fukuda et al., 1998; Kelsall et al., 2009; Proctor et al., 1998; Unwin et al., 2002; White et al., 2016). Though some of these problems aligned with known medical conditions (e.g., chronic fatigue syndrome), a substantial minority of deployed Gulf War veterans reported an enduring constellation of medically *unexplained* symptoms, subsequently and collectively referred to as "Gulf War Illness" or "Chronic Multisymptom Illness" (GWI/CMI; Institute of Medicine, 2014). In addition to physical health problems, deployed Gulf War veterans also developed certain psychiatric disorders at higher rates than their non-deployed Gulf War Era veteran counterparts—namely, posttraumatic stress disorder (PTSD) and depression (Toomey et al., 2007).

To better address the medical and mental health needs of Gulf War veterans, investigators have sought to identify reliable risk factors of poor health outcomes in this cohort. One potentially contributing factor is exposure to nuclear, biological, and chemical agents (NBCs). Specifically, Gulf War service members may have encountered NBCs such as hazardous pesticides, oil fire smoke, anti-nerve gas pills, and chemical warfare agents during deployment (Research Advisory Committee on Gulf War Veterans' Illnesses, 2014; Riegle, 1994; White et al., 2016), and research has documented simple and dose-response relationships between NBC exposure and poor health outcomes in Gulf War veterans (King et al., 2008; Proctor et al., 1998; Wolfe et al., 2002). Another possible contributing factor is combat exposure. Combat exposure is strongly associated with post-deployment psychiatric

disorders such as PTSD and depression (Kimbrel et al., 2015, 2014; King et al., 2006; Luxton et al., 2010; Toomey et al., 2007), and it has also been linked to certain medical problems in Gulf War veterans including GWI/CMI, pain, and respiratory issues (e.g., Porter et al., 2019; Sheffler et al., 2016; White et al., 2016).

Although prior research documents associations between military service-related exposures and post-deployment health, these associations do not fully explain medical and mental health outcomes among deployed Gulf War veterans. Moreover, because combat exposure and NBC exposure are both intractable historical factors, their clinical intervention utility is limited. Given the barriers to understanding Gulf War veteran health based on service-related exposures alone, experts have called for adopting a biopsychosocial perspective to better meet Gulf War veteran's health needs (Ferrari, 2000; Ferrari and Russell, 2001; Wojcik and Lawrie, 2016). Relative to biomedical approaches, the biopsychosocial model takes a more comprehensive approach to conceptualizing physical health complaints by considering the cognitive, affective, and behavioral forces shaping physiological functioning (Engel, 1977). That is not to say certain symptoms cannot have organic (biological) sources according to this framework; rather, it posits that health symptoms can arise from *multiple* sources and that psychosocial phenomena can both amplify and alleviate physiological symptoms (Ferrari, 2000). The biopsychosocial model has been successfully applied to idiopathic conditions such as chronic pain and irritable bowel syndrome (Bevers et al., 2016; Gatchel et al., 2007; Halpert and Drossman, 2005; Van Oudenhove et al., 2016). It also has clear implications for Gulf War veteran health assessment and intervention and lends itself well to holistic health care (e.g., the Department of Veterans Affairs' "Whole Health" model; Krejci et al., 2014). As many common Gulf War veteran health problems are chronic and difficult to treat (Porter et al., 2019; Proctor et al., 1998; White et al., 2016), research aimed at identifying modifiable psychosocial influences on post-deployment medical and mental health could meaningfully contribute to Gulf War veteran health theory, research, and practice.

One candidate psychosocial factor is experiential avoidance (EA). EA is the phenomenon whereby a person is unable or unwilling to remain in contact with aversive internal events (e.g., unwanted memories, emotions, and physical sensations) and consequently acts to avoid, alter, or escape their unpleasant internal experiences (Hayes et al., 1996). Though EA might be adaptive in theater or in the immediate aftermath of deployment stress (Bowes et al., 2018; Brockman et al., 2016; Cobb et al., 2017), persistent escape/avoidance of unwanted internal experiences can ironically maintain and even worsen psychiatric symptoms in the long-term (Chawla and Ostafin, 2007; Kashdan, 2010). Indeed, EA has been linked to both PTSD and depression in U.S. military veterans in numerous studies (Avery et al., 2018; Brockman et al., 2016; Bryan et al., 2015; Byllesby et al., 2020; Elliott et al., 2015; Kelly et al., 2019; Meyer et al., 2013, 2019b, 2019c, 2019a, 2018a).

Although most research on EA has focused on EA's role in the maintenance of mental health disorders, there is also a burgeoning parallel literature on EA in the context of chronic *medical* conditions. Specifically, studies in patient samples show EA is significantly associated with chronic pain intensity and interference (Cook et al., 2015; Karademas et al., 2017; McCracken and Velleman, 2010; Trainor et al., 2019) as well as irritable

bowel syndrome severity and interference (Cassar et al., 2018; Ferreira et al., 2018, 2011; Gillanders et al., 2017). In addition to various pain- and gastrointestinal-related conditions, qualitative research suggests EA is associated with poorer functional adaptation to respiratory conditions like asthma and chronic obstructive pulmonary disease (COPD; Boot et al., 2009). Although one recent study found preliminary evidence for a mediating effect of EA on the relationship between generalized anxiety and asthma outcomes (Michalova et al., 2021), quantitative research linking EA to respiratory disorders is scant and remains an important focus for future research. Taken together, although previous studies suggest EA could meaningfully inform clinical models of chronic illnesses, they were all conducted using relatively small convenience samples. Consequently, it remains unknown whether EA helps explain physical health outcomes among U.S. veterans generally, and Gulf War veterans in particular.

The current study was designed to build upon previous work by investigating the relation of EA to medical and mental health outcomes in a national sample of deployed Gulf War veterans—a veteran cohort with especially high rates of chronic and disabling health concerns, in addition to PTSD and depression (Proctor et al., 1998; Toomey et al., 2007). Previous research has linked EA to PTSD and depression in veteran samples (but not Gulf War veterans) and EA is rarely assessed in research on physical health problems in veterans. Based on the literature reviewed above, we hypothesized that higher (worse) EA would be associated with higher lifetime odds of PTSD and depression, even after adjusting for demographic covariates and military service-related exposures. We additionally hypothesized that after adjusting for demographic covariates and military service-related exposures, higher EA would be associated with higher lifetime odds of GWI/CMI and fatigue-, pain-, respiratory-, and gastrointestinal-related medical diagnoses commonly observed among deployed Gulf War veterans.

Methods and Materials

Participants and Procedure

Data included in the present analyses were collected as part of a larger Gulf War study focused on the healthcare needs of Gulf War veterans (Grant 1I01HX001682). This project, entitled Gulf War Research and Individual Testimony (Project GRIT; $N = 1,153$), included a national survey of Gulf War veterans' healthcare needs, utilization patterns, and associated costs. Participants were eligible for inclusion in the current analysis if they endorsed being deployed to the Persian Gulf region (i.e., Kuwait, Iraq, and Saudi Arabia) any time between August 1990 and July 1991 as part of their U.S. military service.

The Project GRIT survey, conducted January 2019 to August 2020, was administered to a national cohort of deployed Gulf War and non-deployed Gulf War Era U.S. veterans. All study procedures, including consent and HIPAA authorization waivers, were approved by the Institutional Review Boards at the Durham Veterans Affairs (VA) Health Care System and the VA Salt Lake City Health Care System. Potential participants were first identified from a VA administrative database of patients (SPatient file). To be eligible, potential respondents had to have a history of military service during the Gulf War in the administrative record, regardless of whether or not they had deployed, resulting in

an initial cohort of 1,098,991 Gulf War Era veterans, including 133,461 women veterans (12.14%). Cohort participants were then categorized into eight geographic regions providing nationwide representation. Stratified random sampling was used to identify a sample of 6,000 veterans (including 750 veterans from each of the 8 geographic regions) to potentially contact for recruitment to complete the Project GRIT survey. Women veterans were oversampled (25%; 1,500/6,000) to ensure sufficient representation in the final sample.

A modified Dillman approach (Dillman et al., 2014) involving multiple and multimethod contacts was used to maximize participant response rate. Eligible veterans were first sent pre-notification letters on VA letterhead describing the purpose and nature of the study, the expected study completion time, and instructions for how to opt out of the study. Eligible veterans were informed in the study information letters that they could complete the survey by telephone, if they preferred, but no participants elected to do so. To incentivize study participation, veterans were also informed that respondents who completed and returned the survey would be entered into a lottery drawing for opportunities to win either $100 or $500 (50 total $100 prizes and 10 total $500 prizes were awarded). To encourage timely study completion, veterans were also informed they would have a greater chance of being selected as a lottery raffle winner if they returned their surveys sooner because they would be considered for a greater number of raffle drawings over time.

One week later, veterans who had not opted out of the study were sent a physical survey copy, another copy of the study information letter describing the project and key elements of informed consent, and a small token of appreciation (a challenge coin with the study name printed on it) along with a pre-paid return envelope. Participants' consent was inferred from their willingness to complete and return the survey. Approximately two weeks later, a reminder letter was mailed to eligible veterans who had not yet returned their survey. One week after the reminder mailing, non-responders were sent a duplicate packet with another study information sheet, physical survey copy, a complimentary pen, and instructions for how to opt out of the study.

A total of 3,272 veterans were contacted about the survey from the initial pool of 6,000 potential participants. Of the 3,272 surveys that were mailed to prospective participants, 548 surveys were returned to the study site due to incorrect/outdated mailing addresses, resulting in a total 2,724 surveys received by participants. Thirty-two veterans opted out of the study and 1,153 veteran participants completed and returned the survey, resulting in an overall survey response rate of 42.3% (1,153/2,724) and a survey return rate of 35.2% (1,153/3,272). Consistent with our goal of oversampling for women veterans, the final cohort of Project GRIT participants contained a significantly higher number of women veterans than did the national cohort from which we sampled (21.6% vs. 12.1%, $p < .001$). The mean age of Project GRIT participants ($M = 58.8$, $SD = 7.3$) was approximately 0.6 years higher than the mean age of the national cohort in 2020 (the year that most participants completed the survey; $M = 58.2$, $SD = 7.7$, z = 2.51, $p = .006$). Comparing the racial demographics of survey respondents to the population among those with non-missing race data in Veterans Health Administration (VHA) electronic records indicated that the survey sample was similar to the population in the proportion of veterans who identified as White

(61.3% vs. 63.1%, z = −1.28, $p > .05$) or as a racial minority (38.7% vs. 36.9%, z = 1.26, $p > .05$).

Of the 1,153 Project GRIT survey respondents, $n = 454$ endorsed being military deployment to the Persian Gulf War region between August 1990 and July 1991 ($n = 674$ denied, $n = 25$ responses missing) and were included in the current study's analyses. Descriptive statistics for the analyzed sample are presented in Table 1. See Figure 1 for an illustration of participant flow.

Measures

Demographic Information.—Veterans reported their age, sex, race, ethnicity, marital status, and Department of Veterans Affairs (VA) service-connection status.

Mental and Medical Health Outcomes.—Veterans reported whether they had ever been diagnosed with the following problems using a yes/no response format: PTSD, depression, GWI/CMI, gastrointestinal problems, irritable bowel syndrome, arthritis, fibromyalgia, chronic fatigue syndrome, asthma, and COPD/emphysema.

Combat Exposure.—Combat exposure was assessed with the 7-item Critical Warzone Experiences Scale (Kimbrel et al., 2014). Respondents rated the frequency to which they experienced each event during combat (e.g., "being directly responsible for the death of an enemy combatant") using a 5-point Likert scale ranging from 0 (*Never*) to 4 (*10 or more times*). Combat exposure was dichotomized as either endorsed (score > 0) or denied (score = 0). The Critical Warzone Experiences Scale has demonstrated a single factor structure, good internal consistency, good test-retest reliability, and good convergent validity with other combat exposure scales (Kimbrel et al., 2015, 2014). Internal consistency in the current sample was good (Cronbach's $\alpha = .84$).

NBC Exposure.—NBC exposure was assessed with the Deployment Risk & Resilience Inventory-2 (DRRI-2; Vogt et al., 2012) NBC Exposure subscale (Section F), which includes 13 polytomous items. Respondents rated the extent to which they believed they encountered various NBCs during military deployment, which were scored as 0 (*No*), 1 (*Not sure*), or 2 (*Yes*). The DRRI-2 has demonstrated strong internal consistency and criterion-related validity in previous work (Vogt et al., 2013). Internal consistency in the current sample was excellent (Cronbach's $\alpha = .91$).

Experiential Avoidance.—EA was assessed with the Brief Experiential Avoidance Questionnaire (BEAQ; Gámez et al., 2014), a validated 15-item measure derived from the longer Multidimensional Experiential Avoidance Questionnaire (MEAQ; Gámez et al., 2011). Respondents rated the degree to which they agreed with each item (e.g., "I go out of my way to avoid uncomfortable situations") using a 7-point Likert scale ranging from 0 (*Strongly disagree*) to 6 (*Strongly agree*). One item (item 6; "Fear or anxiety won't stop me from doing something important") is reverse-scored. The BEAQ has shown good internal consistency, convergent validity, and discriminant validity in previous work (Gámez et al., 2014). Internal consistency in the current sample was excellent (Cronbach's $\alpha = .91$).

Data Analytic Plan

Analyses were conducted between February and June 2021 using R Statistical Software Version 4.0.2 (R Foundation for Statistical Computing, 2020). We applied multivariate imputation by chained equations using the "mice" package in *R* (van Buuren and Groothuis-Oudshoorn, 2011) to handle missing data for all variables other than diagnostic outcome variables. Continuous measure internal consistencies were estimated using all available data prior to multiple imputation. Mean item-level DRRI-2 and BEAQ scores were calculated after multiple imputation procedures to yield easily interpretable measures of overall NBC exposure and EA, respectively.

We first computed descriptive statistics to characterize the sample's sociodemographic background and health histories. We then conducted chi-square tests of independence to examine bivariate associations between putative health risk factors (i.e., age, sex, race, combat exposure, NBC exposure, and EA) and health outcomes. Continuous measures of participant age (*Mdn* age = 56 years old), NBC exposure (*Mdn* = 1.54) and EA (*Mdn* = 2.73) were dichotomized via median-split in the full sample for chi-square analyses only.

Next, we computed a series of logistic regression models to test our hypotheses regarding the multivariate effects of EA on health outcomes after adjusting for age, sex, race, combat exposure, and NBC exposure. Effect sizes accompany all bivariate (Cranmer's φ; Kotrlik et al., 2011) and multivariate (Cohen's *d*; Chinn, 2000) estimates. For ease of presentation, only EA-related estimates and effect sizes are displayed in the tables; complete output is included in the Supplementary File.

Results

Preliminary Analyses

Visual inspection and quantitative analysis (i.e., skewness and kurtosis) of continuous measure data suggested approximately normal distribution. Our national sample of deployed Gulf War veterans had an average 57.14 years of age (*SD* = 7.20; ages ranged 47 to 90 years old). Mean item-level scores indicated the overall sample reported moderately high perceived NBC exposure (*M* = 1.36, *SD* = 0.61, *n* = 15 missing) and fairly low (i.e., relatively good) EA (BEAQ: *M* = 2.86, *SD* = 1.24, *n* = 0 missing). Shown in Table 1, our sample was mostly white, married, and VA service-connected. Nearly two-thirds of the sample endorsed combat exposure. Rates of lifetime PTSD and depression in our sample were comparable to each other. The most commonly endorsed medical diagnoses were arthritis, irritable bowel syndrome, and GWI/CMI.

Bivariate Analyses

EA-related findings from chi-square tests of independence are summarized in Table 2 (see Supplementary File for complete results). Higher EA was significantly associated with lifetime diagnoses of PTSD, depression, GWI/CMI, gastrointestinal problems, irritable bowel syndrome, arthritis, fibromyalgia, chronic fatigue syndrome, and asthma (*p*s ≤ .021; effect sizes ranged small to moderate). EA was not significantly associated with lifetime COPD/emphysema at the bivariate level.

Multivariate Analyses

EA-related logistic regression findings are summarized in Table 3 (see Supplementary File for complete results). Mental health analyses supported study hypotheses. After adjusting for demographic covariates, combat exposure, and NBC exposure, greater (worse) EA was associated with significantly higher odds of lifetime PTSD and depression. Medical health analyses partially supported hypotheses. After adjusting for demographic covariates and military-related exposures, higher EA was associated with significantly higher odds of lifetime GWI/CMI, gastrointestinal problems, irritable bowel syndrome, arthritis, fibromyalgia, and chronic fatigue syndrome, (effect sizes ranged small to large), but not asthma or COPD/emphysema.

Discussion

U.S. veterans deployed to the Persian Gulf region in service of 1990–1991 Gulf War military operations have endorsed higher rates of mental health problems such as PTSD and depression than their non-deployed Gulf War Era veteran counterparts (Toomey et al., 2007). Moreover, deployed Gulf War veterans reported chronic, often idiopathic physical symptoms at higher rates than either non-deployed Gulf War Era veterans or veterans deployed to other regions during the same time period (Kang et al., 2009, 2003; Proctor et al., 1998; The Iowa Persian Gulf Study Group, 1997). Despite public and scientific interest in better understanding and optimizing Gulf War veteran health, etiologies for many common Gulf War veteran health problems are unknown and prognosis can be poor (White et al., 2016). The biopsychosocial model (Engel, 1977), which emphasizes the influence of physiological *and* psychosocial factors on health functioning, could meaningfully improve clinical models and interventions for Gulf War veteran health outcomes. The current study recruited a large national sample of deployed Gulf War veterans to test the hypothesis that EA—a psychosocial risk factor for numerous mental health disorders and certain medical health conditions—would be significantly associated with higher lifetime odds of PTSD, depression, and chronic illnesses commonly observed among deployed Gulf War veterans.

Rates of self-reported health diagnoses in our sample were comparable to previously studied samples of deployed Gulf War veterans (Dursa et al., 2020; Eisen et al., 2005; Karlinsky et al., 2004; Kipen et al., 1999; Tuteja et al., 2019; Zundel et al., 2019), although rates of asthma, COPD/emphysema, and arthritis were slightly higher than in prior studies (Dursa et al., 2020; Eisen et al., 2005; Karlinsky et al., 2004). Bivariate EA associations were strongest for PTSD and depression, but chi-square analyses also detected significant relationships between EA and lifetime diagnoses of GWI/CMI, gastrointestinal problems, irritable bowel syndrome, arthritis, fibromyalgia, chronic fatigue syndrome, and asthma. Logistic regression analyses adjusting for demographic factors and military-related exposures partially supported our hypotheses. Consistent with previous work in other veteran samples (Avery et al., 2018; Brockman et al., 2016; Bryan et al., 2015; Byllesby et al., 2020; Elliott et al., 2015; Kelly et al., 2019; Meyer et al., 2013, 2019b, 2019c, 2019a, 2018a), EA was associated with lifetime histories of PTSD and depression in multivariate analyses. Higher (i.e., worse) EA was also associated with higher odds of lifetime GWI/CMI, gastrointestinal problems, irritable bowel syndrome, arthritis, fibromyalgia, and

chronic fatigue syndrome. Effect sizes for the relationship between EA and mental health outcomes were double to triple the magnitude of those found for the relationship between EA and medical health outcomes.

Contrary to hypotheses, EA was not significantly associated with asthma in multivariate analyses or with COPD/emphysema in either bivariate or multivariate analyses. Our results suggest that EA is less relevant to the experience of respiratory conditions than it is to pain, gastrointestinal, and fatigue-related disorders. Although research on EA and other psychosocial variables in the context of asthma and COPD is limited and equivocal (Michalova et al., 2021), it is possible that EA is less relevant to the maintenance of respiratory disorders than other psychosocial variables (e.g., anxiety sensitivity; Avallone et al., 2012; Simon et al., 2006; Witcraft et al., 2021).

Taken together, our findings suggest that the tendency to avoid, suppress, or otherwise attempt to control unpleasant internal experiences (e.g., thoughts, memories, and physical sensations) is related to many of deployed Gulf War veterans' chronic medical and mental health problems. Our results align with previous work identifying EA as a prospective risk factor for various health problems (Berghoff et al., 2017; Chawla and Ostafin, 2007; Hildebrandt and Hayes, 2012; Spinhoven et al., 2014) and functional disability in veterans with chronic pain even after accounting for pain intensity and mental health symptoms (Cook et al., 2015). This study's findings have positive implications for treatment; whereas providers cannot intervene on historical variables tied to poor health outcomes in this cohort (e.g., combat exposure and NBC exposure), psychosocial factors such as EA *are* modifiable biopsychosocial treatment targets. Though generally considered a stable trait (e.g., Spinhoven et al., 2014), previous clinical trials of psychosocial treatments showed EA was sensitive to change during standard VA inpatient and outpatient PTSD treatment (Byllesby et al., 2020). Other studies have shown that Acceptance and Commitment Therapy (ACT), which purports to exert therapeutic benefit in part by reducing EA, was useful for veterans with comorbid PTSD and alcohol use disorder (Meyer et al., 2018b) as well as Navy recruits with training injury-related acute pain (Udell et al., 2018). Other similar approaches (e.g., mindfulness-based treatment for PTSD, "transdiagnostic" cognitive-behavior therapy for anxiety) have also been shown to reduce EA among veterans (Espejo et al., 2017; Reyes et al., 2020). Understood within this larger literature, our findings suggest that adding acceptance-based, mindfulness-based, or cognitive-behavioral interventions as part of a biopsychosocial treatment plan could incrementally improve Gulf War veteran physical and mental health outcomes. Future research directly testing whether changes in EA during treatment facilitate improvements in symptom severity and/or functioning among Gulf War veterans is warranted.

Our findings also suggest it would be helpful for specialty medical care providers and mental health care professionals alike to assess for biological *and* psychosocial risk factors such as EA when evaluating patients with complex symptom presentations. This recommendation is consistent with VA's whole-person approach to health care, which explicitly considers biological, cognitive, affective, social, and environmental factors shaping health functioning (Krejci et al., 2014). It would also be important for providers to communicate to veterans and their caregivers that physical health complaints are not "in

someone's head," but that the manner in which someone psychologically and behaviorally *responds* to their symptoms can nevertheless influence symptom presentation and prognosis. Considering growing evidence that certain Gulf War-related health conditions (including GWI/CMI) may also affect military personnel deployed to Iraq and Afghanistan during subsequent conflicts (e.g., the Global War on Terrorism; DeBeer et al., 2017), future studies on the role of EA in the experience and treatment of chronic medical and mental health conditions in other veteran cohorts is needed.

This study had several strengths, such as the use of a large, nationally representative sample of deployed Gulf War veterans reporting diverse health histories and variable levels of EA and service-related exposures. Our study replicated previous research linking EA to post-deployment psychiatric disorders and extended prior work by demonstrating EA's relationship to several complex, idiopathic medical conditions commonly reported by Gulf War veterans. Regarding external validity, the national sample of Project GRIT Gulf War/Gulf War Era veterans from which current study data were drawn was comparable to the larger population of VHA-enrolled veterans at the time of study completion in terms of age and race, and women veterans were adequately represented in our sample due to deliberate oversampling of women veterans in Project GRIT. At the same time, our findings should be contextualized by study limitations. Because our study of deployed Gulf War veterans did not include a comparison group, for example, our data do not speak to the association between EA and various medical and mental health diagnoses among non-veterans, non-deployed Gulf War veterans, or veterans of other military conflicts.

Additionally, our cross-sectional design precludes drawing causal inferences. Future research incorporating longitudinal design would help to understand prospective relationships between military experiences, EA, and medical and mental health diagnoses among veterans. Our survey also relied on self-reported diagnoses and retrospective assessment of military service-related exposures, which could have been biased by recall error. Nor can we rule out the influence of other medical and mental illness risk factors such as social support (Ren et al., 1999) or somatosensory catastrophizing (Edwards et al., 2016; Seto and Nakao, 2017) on diagnostic outcomes.

Another limiting factor regards how EA was measured in this study. Although EA was originally conceptualized as a general unwillingness to experience a broad set of unpleasant internal states (Hayes et al., 1996), investigators have recently demonstrated that EA can also be specific to certain issues such as substance use (Luoma et al., 2011), psychotic symptoms (Shawyer et al., 2007), body image concerns (Sandoz et al., 2013), obsessive-compulsive symptoms (Jacoby et al., 2018), trichotillomania (Houghton et al., 2014), and social anxiety (MacKenzie and Kocovski, 2010). Thus, although our sample reported fairly low (i.e., adaptive) EA overall, we do not know whether veteran participants would have endorsed higher (i.e., worse) EA if asked to specifically consider their deployment-related experiences when responding. One worthwhile area of future research, therefore, would be to develop military-specific measures of EA to more precisely investigate the associations between military deployment, EA, and post-deployment health outcomes. These limitations notwithstanding, our study provides empirical support for the incremental utility of incorporating transdiagnostic biopsychosocial variables into veteran

health case conceptualization and assessment. Future research testing whether holistic treatment approaches lead to superior Gulf War veteran health outcomes–and whether those treatment improvements are driven by reductions in EA—would also be helpful.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Many Gulf War veterans have developed chronic, difficult-to-treat illnesses
- Biopsychosocial models can improve chronic illness diagnosis and treatment
- Experiential avoidance (EA) is a psychosocial mental/medical illness risk factor
- EA was associated with PTSD, depression, and several chronic medical illnesses
- EA-focused assessment and intervention might improve Gulf War veterans' health

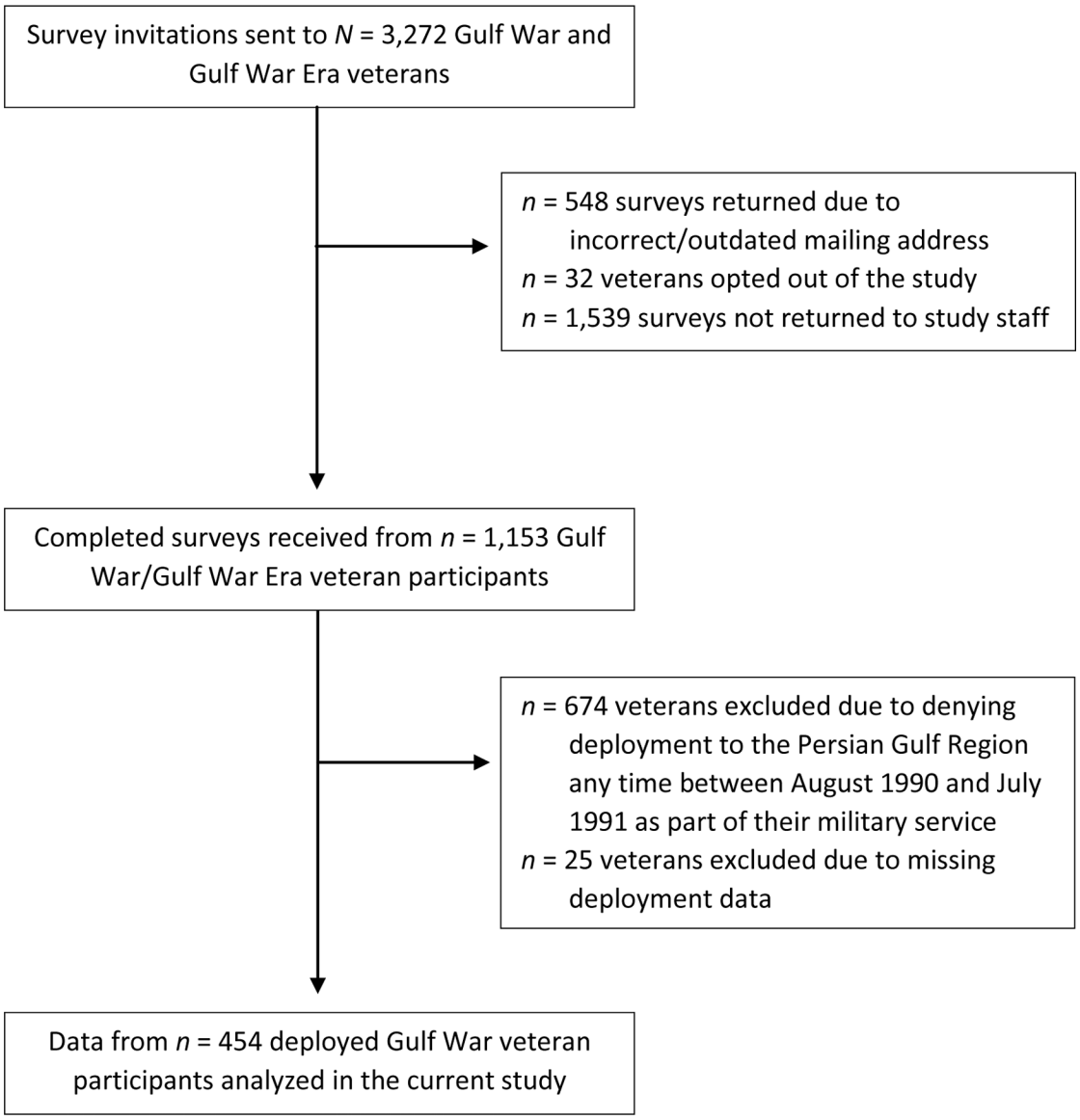

Figure 1.
Participant Flow

Table 1

Characteristics of Deployed Gulf War Veteran Sample (N = 454)

Characteristic	Missing Data		Observed	
	n	%	*n*	%
Sex	9	(1.98)		
Male			397	(87.44)
Female			48	(10.57)
Race	9	(1.98)		
White			243	(53.52)
American Indian or Alaska Native			19	(4.19)
Asian			6	(1.32)
Black or African American			105	(23.13)
Native Hawaiian or Pacific Islander			1	(0.22)
Other			31	(6.83)
Hispanic	15	(3.30)	40	(8.81)
Marital status	9	(1.98)		
Married, live together			327	(72.03)
Live together, committed relationship			20	(4.41)
Married, separated			11	(2.42)
Divorced			59	(13.00)
Widowed			6	(1.32)
Single, never married			22	(4.85)
VA Service Connected	13	(2.86)	339	(74.67)
Endorsed any combat exposure	10	(2.20)	310	(68.28)
Lifetime mental health diagnoses				
PTSD	37	(8.15)	173	(38.11)
Depression	37	(8.15)	183	(40.31)
Lifetime medical diagnoses				
GWI/CMI	64	(14.10)	89	(19.60)
Gastrointestinal problems	45	(9.91)	164	(36.12)
Irritable bowel syndrome	52	(11.45)	92	(20.26)
Arthritis	36	(7.93)	222	(48.90)
Fibromyalgia	57	(12.56)	33	(7.27)
Chronic fatigue syndrome	54	(11.89)	81	(17.84)
Asthma	57	(12.56)	64	(14.10)
COPD or emphysema	61	(13.44)	35	(7.71)

Note. All percentages based on the full *N* = 454 sample; VA = Department of Veterans Affairs; PTSD = posttraumatic stress disorder; GWI/CMI = Gulf War Illness/Chronic Multisymptom Illness; COPD = chronic obstructive pulmonary disease.

Table 2

Summary of Bivariate (Chi-Square) Tests of Associations between EA and Health Outcomes

Lifetime Diagnosis	High EA (*n* = 238)		Low EA (*n* = 216)		X^2	φ	*p*
	n	%	*n*	%			
PTSD	138	(30.40)	35	(7.71)	85.07	.45	< .001
Depression	135	(29.74)	48	(10.57)	59.07	.38	< .001
GWI/CMI	66	(14.54)	23	(5.07)	23.62	.25	< .001
Gastrointestinal problems	102	(22.47)	62	(13.66)	12.90	.18	< .001
Irritable bowel syndrome	64	(14.10)	28	(6.17)	15.18	.19	< .001
Arthritis	133	(29.30)	89	(19.60)	9.41	.15	.002
Fibromyalgia	26	(5.73)	7	(1.54)	10.82	.17	.001
Chronic fatigue syndrome	64	(14.10)	17	(3.74)	30.23	.27	< .001
Asthma	42	(9.25)	22	(4.85)	5.36	< .01	.021
COPD or emphysema	18	(3.96)	17	(3.74)	< 0.01	< .01	.953

Note. Percentages based on the full *N* = 454 sample; degrees of freedom for all tests = 1; EA = experiential avoidance; φ = phi effect size coefficient, where 0.1, 0.3, and 0.5 signify effects of small, medium, and large magnitude, respectively; see Table 1 for information about missing data for each individual diagnostic outcome variable; see Supplementary File for complete output.

Table 3

Summary of Multivariate (Logistic Regression) Tests of Associations between EA and Health Outcomes

	Multivariate Effect of EA, Adjusting for Age, Sex, Race, Combat Exposure, and NBC Exposure				
Lifetime Mental Health Diagnosis	**OR**	**95% CI**		***c***	***d***
		Lower	**Upper**		
PTSD	2.89***	2.28	3.73	.86	0.59
Depression	2.25***	1.83	2.80	.79	0.45
Lifetime Medical Diagnosis	**OR**	**95% CI**		***c***	***d***
		Lower	**Upper**		
GWI/CMI	1.50***	1.19	1.90	.78	0.22
Gastrointestinal problems	1.28**	1.07	1.54	.64	0.14
Irritable bowel syndrome	1.35**	1.09	1.67	.70	0.17
Arthritis	1.25*	1.05	1.49	.67	0.12
Fibromyalgia	1.57**	1.14	2.21	.77	0.25
Chronic fatigue syndrome	1.74***	1.39	2.22	.73	0.31
Asthma	1.25	0.98	1.59	.65	0.12
COPD or emphysema	1.05	0.77	1.42	.64	0.03

Note: OR = odds ratio; CI = confidence interval; effect size *d* approximated using procedures described by Chinn (2000), where 0.1, 0.3, and 0.5 signify effects of small, medium, and large magnitude, respectively;

* $p < .05$,

** $p < .01$,

*** $p < .001$;

see Supplementary File for complete output.