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Behavioral inhibition and PTSD symptoms in veterans

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ABSTRACT

Behavioral inhibition (BI), a temperamental bias to respond to novel stimuli with avoidance behaviors, is a risk factor for posttraumatic stress disorder (PTSD). It is unclear whether BI accounts for additional variance in PTSD symptom severity beyond that accounted for by general anxiety. Here, 109 veterans (mean age 50.4 years, 9.2% female) provided self-assessment of PTSD symptoms, state and trait anxiety, combat exposure, and current (adult) and retrospective (childhood) BI. Adult BI was correlated with anxiety and PTSD symptom severity, especially cluster C (avoidance) symptoms, but not with combat exposure. A regression model including adult BI, state and trait anxiety, and combat exposure was able to correctly classify over 80% of participants according to presence or absence of severe PTSD symptoms. Because avoidance behaviors are a core component of PTSD, self-assessments of BI may be an important tool in understanding PTSD and potentially assessing vulnerability to the disorder.

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1. Introduction

Although military personnel may have vulnerabilities for anxiety disorders similar to the non-military population, the extreme and constant stressors of deployment, war, and wartime service enhance the likelihood of developing post-traumatic stress disorder (PTSD). However, the development of PTSD is the exception not the rule (Bonanno, 2004). For example, only about 9% of individuals exposed to any form of traumatic event develop PTSD (Breslau et al., 1998). In comparison, one study estimated that less than 15–20% of military personnel returning from combat duty in Afghanistan or Iraq met PTSD criteria 3–4 months later (Hoge et al., 2004), while a recent re-examination of data on Vietnam-era veterans found a lifetime PTSD prevalence of 19% (Dohrenwend et al., 2006). Thus, although PTSD prevalence is generally higher among veterans than among the general population, the large majority do not develop PTSD. The wide range of PTSD symptom severity among individuals exposed to similarly stressful traumatic events (Pitman et al., 1987; Orr et al., 1993; Shalev et al., 1993; McNally, 2003) indicates that pre-existing vulnerability factors critically modulate an individual's risk to develop PTSD.

One such vulnerability factor is trait anxiety, a relatively stable tendency to perceive stressful situations as dangerous or threatening, and to respond with short-term elevations in current (state) anxiety (Spielberger, 1983). The Spielberger State-Trait Anxiety Inventory (STAI; Spielberger, 1983) is a self-report tool that can be used to assess both state and trait anxiety. The STAI has relatively high test–retest stability as well as correlation with other measures of trait anxiety. Individuals with a diagnosis of PTSD generally have higher Trait Anxiety as measured by the STAI, compared to non-PTSD controls (e.g., Orsillo et al., 1996; Casada and Roache, 2005, 2006), and in one prospective study, high peritraumatic STAI Trait Anxiety among individuals undergoing surgery is associated with higher rates of PTSD symptoms 2–5 years later (Ristvedt and Trinkaus, 2009). In fact, some studies suggest that trait anxiety is a stronger determinant of PTSD symptom severity than the nature of the traumatic event (Lonigan et al., 1994; Phipps et al., 2009). However, the STAI indexes general anxiety and as such is related to risk for a wide range of anxiety disorders, including but not limited to PTSD. It is possible that, by closely examining temperamental variables directly associated with PTSD symptoms, better predictions of risk and vulnerability will be possible.

As defined by the DSM-IV, PTSD symptoms fall into three clusters: re-experiencing (cluster B), avoidance (cluster C), and arousal (cluster D). Although a minimum number of symptoms in each cluster is required for a PTSD diagnosis, avoidance symptoms may be particularly relevant in determining which trauma-exposed individuals are likely to develop PTSD and whether that PTSD is likely to be chronic or remitting. Specifically, whereas re-experiencing and arousal symptoms are relatively common among trauma-exposed individuals, occurring in about 60–80% and 30–60% of cases, respectively, avoidance symptoms are relatively less frequent, observed in only about 10–50% of trauma-exposed individuals (Maes et al., 1998; Breslau et al., 1999). Trauma-exposed individuals who report avoidance symptoms have a particularly high probability of developing

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PTSD (North et al., 1999). In addition, presence and intensity of avoidance symptoms may be particularly stable over time (Solomon et al., 2009) and may be related to a more chronic, rather than remitting, course of illness in PTSD (Maes et al., 1998).

Given the importance of avoidance to the development of PTSD, the propensity for avoidance behaviors may be a particularly important vulnerability factor contributing to PTSD risk in trauma-exposed individuals. Indeed, one prospective study found that individuals with personality traits related to avoidance and avoidant behaviors, who were then exposed to trauma (terrorist attack), were at heightened risk for development of PTSD (Gil and Caspi, 2006).

Behavioral inhibition (BI) is defined as a temperamental tendency to withdraw from or avoid novel social and non-social situations (Kagan et al., 1987; Morgan, 2006). As such, individuals with high behavioral inhibition should be at heightened risk to respond to stressful situations with avoidance, possibly leading to vulnerability to PTSD and expression of avoidance symptoms. The Adult and Retrospective Measures of Behavioural Inhibition (AMBI/RMBI; Gladstone and Parker, 2005; Gladstone et al., 2005) are a pair of self-report tools to measure current (adult) and childhood (retrospective) BI. A prior study with veterans documented that AMBI and RMBI scores were higher in veterans with severe self-reported PTSD symptoms, indicating an association between behavioral inhibition and PTSD symptom severity (Myers et al., 2012). An unresolved question is whether behavioral inhibition as measured by the AMBI/RMBI and general anxiety as assessed by STAI are separable vulnerability factors. In other words, is BI a useful predictor of PTSD symptoms, accounting for additional variance beyond that which is already accounted for by general anxiety?

Here, we recruited and tested a group of veterans, both with and without history of exposure to combat, to examine (1) whether self-reported BI correlated with PTSD symptom severity and specifically with avoidance symptoms in veterans, and if so (2) whether BI could account for additional variance in PTSD symptoms, beyond that accounted for by trait anxiety alone. As a secondary goal, because combat exposure is a well-documented risk factor for PTSD, we examined (3) whether either BI or trait anxiety was significantly higher in veterans with combat exposure. If so, that might suggest that high BI and/or Trait Anxiety are acquired in the wake of exposure to traumatic events such as combat; if not, BI and Trait Anxiety would be more likely to be pre-existing traits rather than to develop in the aftermath of exposure to traumatic events.

2. Methods

2.1. Subjects

109 veterans were recruited from the New Jersey Health Care System (NJHCS), East Orange, NJ, with mean age of 50.4 years (S.D. 9.1, range 23–65) and mean education of 12.8 years (S.D. 1.8, range 6–20, including 62 with high school or less, 43 with 1+ years of college, and four with postgraduate education). The sample included 10 females (9.2%). Participants identified themselves as African-American ($n=88$), Caucasian ($n=14$), Hispanic ($n=4$), Native American ($n=2$), and Other ($n=1$). Asked about conflicts in which they had served, 32 reported serving during the Vietnam conflict (mean age 58.4 years, S.D. 5.4), 10 in Gulf War/Operation Desert Storm (GW/ODS; mean age 41.1 years, S.D. 4.4), 10 in Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF; mean age 34.6 years, S.D. 10.6), and 11 in other conflicts including operations in Bosnia, Granada, and Panama; 46 reported serving in peacetime or no specific conflict. The majority of veterans reporting other/peacetime service reported having served in the era between Vietnam and GW/ODS; mean age for these 57 veterans was 50.3 years (S.D. 5.0). As would be expected, the group who had served in Vietnam was significantly older than the other groups ($F(3,105)=54.63$, $p<0.001$, Tukey post-hoc test, all $p<0.001$), and the GW/ODS and OEF/OIF groups were significantly younger than the other groups (all $p<0.001$) but did not differ from each other ($p=0.062$).

Veterans were not excluded based upon medical or psychiatric history. When asked to self-report current medications; 48 participants (44%) reported taking psychoactive medications; one participant did not provide information. While some participants were able to specify the name of their medications, others reported the type of medication used (e.g., "anxiety meds" or "anti-depressant"). Thus, further analysis regarding medication usage in this sample was not possible.

Participants received payment of $30/h (maximum of $60) for their participation in the study. Testing generally occurred between 1000–1200 and 1300–1500; no systematic differences in subject demographics or experimental data were observed as a function of testing time. All participants gave written informed consent before initiation of any experimental procedures; procedures were approved by the NJHCS Institutional Review Board and were conducted in accordance with the Declaration of Helsinki and guidelines established by the Federal Government for the protection of human subjects.

2.2. Procedures

Participants completed a battery of paper and pencil questionnaires that typically required 20–30 min to complete. The package included a demographic questionnaire as well as the AMBI/RMBI, the STAI, the Combat Exposure Scale (CES; Keane et al., 1989), and the PTSD Checklist-Military version (PCL-M; Blanchard et al., 1996). After completing the questionnaires, participants also performed a 60-minute eyeblink conditioning procedure (data not reported here).

The AMBI is a 16-item self-report inventory that assesses current tendency to respond to new stimuli with inhibition and/or avoidance, and has been shown to be a measure of anxiety proneness (Gladstone and Parker, 2005). Based on previously published norms (Gladstone and Parker, 2005), participants with total AMBI scores from 0 to 15 are classed as "uninhibited" while those with scores of 16+ are classed as "inhibited." In addition, AMBI items group into four subscales derived from factor analysis (Gladstone and Parker, 2005): 'fearful inhibition' (AMBI-FI), 'risk avoidance' (AMBI-RA), 'non-approach' (AMBI-NA), and 'low sociability' (AMBI-LS). In the current sample, internal consistency was high for total AMBI score (Cronbach's alpha = 0.847) and for AMBI-NA, AMBI-FI, and AMBI-LS subscale scores (all alpha > 0.750) but not for AMBI-RA (alpha = −0.092). All AMBI subscale scores were strongly correlated with each other (all $r>0.300$, all $p\leq0.001$).

The RMBI is an 18-item self-report inventory used to assess childhood memories of exhibiting inhibition to the unfamiliar. Based on previously published norms (Gladstone and Parker, 2005), participants with total RMBI scores from 0 to 11 are classed as "uninhibited" while those with scores of 12+ are classed as "inhibited." As with the AMBI, there are four RMBI subscales derived from factor analysis: 'fearful inhibition' (RMBI-FI), 'risk avoidance' (RMBI-RA), 'non-approach' (RMBI-NA), and 'shyness and sensitivity' (RMBI-SS). As originally published, the RMBI allows respondents to endorse a "do not remember" item; such endorsements constitute missing data for the corresponding items on analysis. To avoid this potential for data loss, we used a modified version of the RMBI which eliminated "do not remember" as a response option. In the current sample, internal consistency was high for total RMBI score (Cronbach's alpha = 0.831) and for RMBI-NA, RMBI-FI, and RMBI-SS subscale scores (all alpha > 0.650) but not for RMBI-RA (alpha = −0.300). All RMBI subscale scores were significantly correlated with each other (all $r>0.250$, all $p\leq0.001$) except for RMBI-RA and RMBI-SS ($r=0.111$, $p=0.251$).

The STAI is a 40-item self-report questionnaire that includes scales measuring State Anxiety (STAI-State) and Trait Anxiety (STAI-Trait). Trait Anxiety is assumed to be a relatively stable personality characteristic, while State Anxiety may change with mood and emotion. In the current sample, internal consistency was high for both STAI-State (Cronbach's alpha = 0.949) and STAI-Trait (alpha = 0.933).

The CES is a 7-item self-report questionnaire that assesses exposure to stressful military events. Total CES score was calculated from a sum of weighted scores; as in prior studies (e.g., Ginsberg et al., 2008), veterans with a CES score of 0–7 were classified as non-combat while those with a score of 8+ were classified as having history of exposure to combat.

The PCL-M is a 17-item self-report questionnaire that asks about presence and frequency of PTSD symptoms in response to stressful military experiences; symptoms are rated according to how much they have bothered the participant in the past month. Specific questions correspond to DSM-IV symptom clusters including cluster B (re-experiencing the traumatic event), cluster C (avoidance/numbing), and cluster D (increased arousal). PCL-M scores of 50+ predict PTSD in military samples (Weathers et al., 1993; Blanchard et al., 1996;). Accordingly, we also categorized participants according to presence or absence of current, severe PTSD symptoms (PTSS) based on this cutoff.

2.3. Data analysis

For all questionnaires, missing data values (questions for which no answer was endorsed) were interpolated using the mean value for the remaining items (taking reverse-scored questions into account) or, in the case of AMBI/RMBI and PCL-M, by using the mean values for the remaining items in the same subscale (see also Maguen et al., 2008; Vasterling et al., 2010). In the current sample, nine subjects missed one question apiece (four on RMBI, one on AMBI, one on STAI-Trait, two on STAI-State, one on PCL-M) and one subject missed two on PCL-M. All other subjects completed all items on all questionnaires.

Bivariate linear correlation (Pearson's r) was used to investigate associations between questionnaire scores; independent-samples t-tests and chi-square tests, with Yates continuity correction as appropriate for 2×2 tables, were used to examine group differences in continuous and categorical variables. Stepwise linear regression and logistic regression were used to investigate ability of demographic variables and questionnaire scores to predict PCL-M scores and PTSS classification. The threshold