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Posttraumatic Stress Disorder, Hostile Cognitions and Aggression in Iraq/Afghanistan Era Veterans

Elizabeth E. Van Voorhees, Ph.D.^{a,b,c}, Paul A. Dennis, Ph.D.^{a,c}, Lydia C. Neal^a, Terrell A. Hicks^b, Patrick S. Calhoun, Ph.D.^{a,b,c}, Jean C. Beckham, Ph.D.^{a,b,c}, and Eric B. Elbogen, Ph.D.^{a,b,d}

^aDurham Veterans Affairs Medical Center

^bVISN 6 Mental Illness Research, Education and Clinical Center (MIRECC), Durham Veterans Affairs Medical Center

^cDepartment of Psychiatry and Behavioral Sciences, Duke University Medical Center

^dDepartment of Psychiatry, University of North Carolina School of Medicine

Abstract

OBJECTIVE—Though most veterans with Posttraumatic Stress Disorder (PTSD) are not violent, research has demonstrated that there is substantial minority who are at increased risk. This study tested hypotheses regarding hyperarousal symptoms and hostile cognitions (i.e. “hostility”) as potential mechanisms of the association between PTSD and physical aggression in a longitudinal sample of Iraq/Afghanistan era veterans.

METHOD—U.S. veterans between the ages of 18 and 70 who served in the military after September 11, 2001 were eligible for participation. At baseline, 301 veterans were evaluated for PTSD and completed self-report measures of hostility. At 6 month follow-up 275 veterans and their family members or friends reported on the veteran’s physical aggression over the preceding interval. OLS and logistic regression were used to evaluate relationships among PTSD status, hyperarousal cluster symptoms, and hostility at baseline, and physical aggression at 6 months. Bootstrapping was used to test for the mediation of baseline PTSD and 6-month aggression by hostility.

RESULTS—PTSD significantly predicted physical aggression over 6 months, but hyperarousal cluster symptoms did not account for unique variance among the three clusters. Hostility partially mediated the association of PTSD at baseline and physical aggression at 6 months.

CONCLUSIONS—Hostility may be a mechanism of the association of PTSD and physical aggression in veterans, suggesting the potential utility of targeting hostile cognitions in therapy for anger and aggression in veterans with PTSD.

U.S. Iraq and Afghanistan veterans report that controlling anger and aggressive urges are primary readjustment concerns (Sayer et al., 2010), and difficulties associated with post-

Correspondence concerning this article should be addressed to: Elizabeth E. Van Voorhees, B16, 2nd floor, Durham Veterans Affairs Medical Center, 508 Fulton Street, Durham, NC 27705. e.vanv@duke.edu; Elizabeth.vanvoorhees@va.gov.

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deployment anger and aggression include domestic violence, ineffective parenting, unsafe driving, employment difficulties, and social alienation (Rodriguez, Holowka, & Marx, 2012; Thomas et al., 2010). In Iraq war era veterans, both self-reported aggressive behaviors (Thomas et al., 2010) and concerns about interpersonal conflict (Milliken, Auchterlonie, & Hoge, 2007) have been found to significantly increase from 3 to 12 months post-deployment. Untreated, the effects may persist for decades past military service (Biddle, Elliott, Creamer, Forbes, & Devilly, 2002). For example, Vietnam veterans, their spouses, and clinicians continue to identify problems with anger and aggression as the highest priority relative to several potential psychiatric concerns, including anxiety, depression, and alcohol problems (Biddle et al., 2002).

Although anger- and aggression-related readjustment difficulties have been reported by veterans in general, meta-analyses have suggested that veterans with posttraumatic stress disorder (PTSD) are most likely to be affected (Orth & Wieland, 2006). For example, research from the National Vietnam Veterans Readjustment Study found that 33% of male veterans with current PTSD reported intimate partner aggression in the previous year, compared to 13.5% of those without current PTSD (Jordan et al., 1992). In a large national cohort sample of UK military personnel linking clinical data to criminal records (Macmanus et al., 2013), 7.2% of those meeting criteria for PTSD had been arrested for violent offending, whereas 3.0% of those not meeting criteria for PTSD had been arrested on violent charges. Finally, in a national longitudinal survey enrolling a random sample of post-9/11 U.S. veterans (Sullivan & Elbogen, 2013), 19.5% of those who met criteria for PTSD reported engaging in community violence in the following year, compared to 6.4% of those who did not meet criteria for PTSD.

Though it is clear that most combat veterans with PTSD are not violent, these studies demonstrate that there is a substantial minority who are at increased risk. If PTSD confers an increased risk for aggression, yet not all combat veterans with PTSD actually engage in aggressive behavior, it is essential to identify variables that distinguish those veterans with PTSD who are aggressive from those who are not. Understanding predictors and mechanisms mediating the association between PTSD and aggression will facilitate the development of effective and targeted interventions for this important but undertreated subgroup.

Several studies in veterans have found that hyperarousal symptoms of PTSD play an important role in risk for aggression. In a study of Vietnam veterans, PTSD hyperarousal symptoms were found to directly predict aggression, whereas numbing and avoidance symptoms were negatively associated with aggression and re-experiencing symptoms had no direct relationship with aggression (Taft et al., 2007). In Iraq/Afghanistan era veterans, PTSD hyperarousal symptoms have been found to predict aggressive impulses or urges, difficulty managing anger, and perceived problems controlling violent behavior even after irritability symptoms were controlled in the analyses (Elbogen, Wagner, et al., 2010). This association between PTSD-related hyperarousal and aggression persists after accounting for comorbid substance dependence, though the association may be complex (Savarese, Suvak, King, & King, 2001).

However, it is likely that additional mechanisms link PTSD to aggression in veterans because hyperarousal symptoms are present in all threshold cases of PTSD according to DSM-IV-TR criteria (and in most cases according to DSM-5 criteria), yet the majority of individuals with PTSD are not aggressive. Further, symptoms of irritability, concentration problems, and sleep disturbance are symptomatic of several other psychiatric and physiological conditions including generalized anxiety disorder and depression (APA, 2013), nicotine withdrawal (Soldatos, Kales, Scharf, Bixler, & Kales, 1980), and premenstrual syndrome (Steiner et al., 1999), none of which have been as consistently linked to aggression. This suggests that other factors are likely to be present in combat-related PTSD that contribute to the increased propensity for violence in a subset of individuals.

One possibility is that cognitions regarding perceived hostility and threat in the environment also contribute to the link between PTSD and violence in veterans. A substantial body of literature has demonstrated that “hostile attribution bias” regarding the intentions of others is associated with aggression (Elbogen & Johnson, 2009). For example, male perpetrators of domestic violence are more likely to attribute negative intent to their wives’ behavior than are their non-violent counterparts (Holtzworth-Munroe & Hutchinson, 1993). In the general population, “perceived hidden threats in others” predicts severe violence, even when controlling for demographics, history of violence, mental illness, and substance abuse (Elbogen & Johnson, 2009).

In military veterans, such attributions may be shaped by military training because the ability for military personnel to respond aggressively without hesitation when called to do so is critical to combat operations. After reports from WWI and WWII suggested that many soldiers never fired their weapons even when under attack, training procedures were adapted to increase the probability that military personnel would engage aggressively with the enemy when necessary (Grossman, 1995). Cognitions that label high levels of arousal as “anger” are more likely to be adaptive in a war zone than are cognitions that are consistent with other negative affect such as fear or sadness (Chemtob, Novaco, Hamada, & Gross, 1997; Gerlock, 1994). Specifically, anger is conducive to an approach or “fight” response to threat because it promotes a sense of power and autonomy, and because it can effectively suppress feelings of guilt, vulnerability, and fear (Gerlock, 1994).

With respect to PTSD specifically, there is some evidence to suggest that compared to veterans without PTSD, combat veterans with PTSD are more likely to hold cognitions consistent with anger such as attributions of malevolent intentions by others. For example, Kubany, Gino, Denny, & Torigoe, (1994) found that Vietnam veterans with PTSD scored higher than veterans without PTSD on the Cook-Medley Hostility Scale (Ho), a well-validated measure of the tendency to hold “current beliefs which reflect an absence of interpersonal trust and doubts about the goodness of other people” (Kubany, Gino, Denny, & Torigoe, 1994, p. 29). In fact, not only did the veterans with PTSD score higher than those without the disorder on cynical hostility, but they also demonstrated higher levels of cynical hostility than any other research population that had previously been examined using the scale (Kubany, Gino, Denny, & Torigoe, 1994).

Taken together, these data suggest that veterans with PTSD who attribute negative intent to others are more likely to respond aggressively to perceived provocation. A comprehensive model of aggression in veterans with PTSD, therefore, should take into account both hyperarousal and negative cognitions. We therefore developed several hypotheses to examine the role that hostile cognitions (e.g. “hostility”) and PTSD hyperarousal cluster symptoms play in the association between PTSD and aggression in veterans with PTSD.

First, to replicate previous research (Kubany et al., 1994), we hypothesized that veterans with PTSD (vs. veterans without PTSD) would demonstrate higher self-reported hostility as measured by the Cook-Medley Hostility Inventory. Second, we sought to extend previous research by hypothesizing that PTSD status at baseline would longitudinally predict physically aggressive behavior at 6 months, and that the hyperarousal cluster would demonstrate the strongest predictive power among the three clusters. Finally, regarding the potential mechanism of the effect of PTSD on future aggression, we hypothesized that hostility would mediate the association of PTSD at baseline and aggression at 6 months.

Methods

Participants and Procedures

English-speaking veterans between the ages of 18 and 70 who served in the military after September 11, 2001 were eligible for participation. Other than age and dates of service, no other exclusionary criteria (psychiatric or medical) were imposed. Participants were recruited through advertisements; mailings to Veterans Affairs (VA)-registered veterans who had served in the military after September 11; information provided to them by clinicians; and enrollment in the Veterans Affairs Registry Database for the Study of Post-Deployment Mental Health. Institutional Review Board approval was obtained before data collection, which spanned June 2009 to March 2013. Veterans called the study hotline and were administered a brief telephone screening. They selected a close family member or friend to serve as collateral informant. If both agreed to participate, data collection was scheduled at the Durham VA Medical Center. All participants provided written informed consent (including confidentiality procedures) after receiving a complete description of the study. Compensation was provided for participation at each assessment session. Assessments were conducted separately with the veteran and collateral informant and included self-report measures and face-to-face interviews.

The study included data collection at baseline and 6 months. Three-hundred and one veterans and collaterals had complete data required for these analyses at baseline (including scores on the Clinician Administered PTSD Scale, CAPS), and 275 veterans had data necessary for analyses at the 6-month follow-up (including baseline scores on the CAPS and 6-month aggression ratings). No significant differences on key demographic or clinical factors were observed between veteran participants at baseline and 6-month follow-up. Mean age of the veteran participants who completed both baseline and 6-month follow-up was 39.6 (10.7) years. Median age was 30, with a range from 21 to 67 years. Mean education was 14.3 (2.2) years and 17.4% of the participants were female. Race data was missing for over half of the sample (52%). Of the 48% for whom race data was available,

41% identified as Caucasian, 57% identified as African-American; and 4% identified as another race (i.e. Asian, Native American, or Pacific Islander).

Measures

Analyses for this investigation utilized a subset of the measures included in a larger study of violence in military veterans. Current PTSD was evaluated using the Clinician Administered PTSD Scale for the DSM-IV (CAPS-IV) (Blake et al., 1995). The CAPS is a structured clinical assessment of PTSD symptom frequency and intensity that was originally validated in veterans, but that has demonstrated strong reliability and validity across a wide range of populations and has become the “gold standard” for PTSD assessment (Weathers, Keane, & Davidson, 2001). The CAPS has been shown to have excellent reliability (*alphas* ranging from .73 to .85 for the three symptom clusters) and excellent convergent and discriminant validity, and to be sensitive to clinical change (Weathers et al., 2001).

The interview was administered to each participant by a licensed clinical psychologist or by a trainee under the direct supervision of a licensed clinical psychologist. All interviewers received intensive training and participated in regular diagnostic supervision sessions. Interrater reliability among the raters across five training tapes showed excellent agreement for diagnosis of current PTSD, Fleiss’ kappa = 1.0 (Fleiss & Cohen, 1973). Training tapes included cases with and without current PTSD from childhood sexual trauma, combat trauma, interpersonal violence, and motor vehicle accidents. The kappa for current PTSD for the eight interviewers who administered the CAPS for this study was 1.0.

A PTSD symptom was considered present based on a rule of frequency > 1 and a severity > 2 (Blake et al., 1995), which has been shown to have good diagnostic utility (Weathers et al., 2001). Continuous values for total CAPS and cluster scores were computed to allow for a small number of missing values per cluster in the following way. The frequency and intensity scores were summed for all items in each cluster to create a total cluster score. The mean was calculated for each total cluster score, and this mean was multiplied by the total number of frequency + intensity items in each cluster scale.

Consistent with the procedures of the MacArthur Violence Risk Assessment Study (Steadman et al., 2000), violent behavior was operationalized using a combination of items endorsed on the Violence Subscale of the Conflicts Tactics Scale (CTS) (Straus, 1979) and the MacArthur Community Violence Scale (Steadman et al., 2000). For this investigation, “physical aggression” was coded 1 if any of the following items were endorsed within the past 6 months by either the participant or collateral reporter: “Used a knife or gun”, “Beat up the other person”, “Threatened the other person with a knife or gun”, “Threw something at the other person”, “Pushed, grabbed, or shoved the other person”, or “Slapped the other person” (from the Conflict Tactics Scale); or “Did you threaten anyone with a gun or knife or other lethal weapon in your hand?”, “Did you use a knife or fire a gun at anyone?”, “Did you try to physically force anyone to have sex against his or her will?”, “Did you throw something at anyone?”, “Did you push, grab, or shove anyone?”, “Did you slap anyone?”, “Did you kick, bite, or choke anyone?”, or “Did you hit anyone with a fist or beat anyone up?” (from the MacArthur Community Violence Scale). Otherwise “physical aggression” was coded 0.

Hostility was measured using the short form of the Cook Medley Hostility Scale (Ho) (Cook & Medley, 1954), a scale derived from the Minnesota Multiphasic Personality Inventory (MMPI) and updated for the MMPI-2 (Han, Weed, Calhoun, & Butcher, 1995). The short form of the scale includes subscales indexing Cynicism, Hostile Affect, and Aggressive Responding, and the Total Ho Score reflects an overall negative and distrustful attitude towards others, a tendency towards negative affect in interpersonal relationships, and a propensity for using and justifying anger and aggression in solving problems (Barefoot, Dodge, Peterson, Dahlstrom, & Williams, 1989). While this scale has rarely been used to examine cognitions associated with aggressive behavior (see Kubany, Gino, Denny, & Torigoe, 1994, for an exception), it has demonstrated good reliability and validity in a number of studies of the association of hostility and health problems (Barefoot et al., 1989).

Covariates included age, gender, alcohol use, and combat exposure. Alcohol use was evaluated using the Alcohol Use Disorders Screening Test (AUDIT) (Reinert & Allen, 2007), and combat exposure was evaluated using the Combat Exposure Scale (CES) (Keane et al., 1989).

Analyses

Age, gender, alcohol use as reported on the AUDIT, and combat exposure as evaluated by the CES were entered as covariates in all models. Ordinary least-squares regression was used to test the hypotheses that PTSD status would be positively associated with hostility. Logistic regression was used to test the hypothesis that hostility would be associated with physical aggression at 6 months; and the hypothesis that PTSD status at baseline would be associated with physical aggression at 6 months. To test the effects of PTSD cluster scores on aggression, the three cluster scores were entered into a logistic regression model predicting physical aggression at 6 months.

Bootstrapping was used to test for mediation of PTSD status and aggression by hostility. Bootstrapped 95% CIs around the indirect effect of PTSD status on aggression *via* hostility were generated using 1,000 re-sampled datasets. This procedure entails re-sampling with replacement to generate a distribution of a given mediation effect. If 0 does not fall within the resulting 95% confidence interval (CI), the mediation effect is deemed significant. Bootstrapping is more powerful than conventional tests, such as Sobel's *z*, because it takes into account the positive skew inherent to mediation effects (Preacher & Hayes, 2008). Bootstrapping was conducted using Hayes' (2012) PROCESS macro for SAS, which generates bias-corrected confidence intervals to further offset the aforementioned positive skew. All analyses were conducted using SAS 9.3.

Results

Demographic and clinical characteristics of the sample with data available at both baseline and 6-month follow-up are presented in Table 1. Bivariate risk factors for physical aggression at 6 months are presented in Table 2.

Results replicated previous findings (Kubany et al., 1994) of an association of PTSD status and Total Hostility (Ho) as measured by the Cook-Medley Hostility Inventory: in the current

sample and controlling for age, gender, total AUDIT score, and combat exposure, PTSD status was significantly associated with Ho ($t=4.22$, $p<.001$). PTSD status at baseline was associated with physically aggressive behavior at 6 months ($\chi^2=7.31$, $p<.01$), with an odds ratio (OR) of 2.11 (95% CI=1.23–3.63).

Contrary to our prediction, in a simultaneous logistic regression model including all 3 clusters and controlling for age, gender, combat exposure score, and AUDIT score, none of the CAPS cluster scores uniquely predicted physical aggression at the 6-month follow-up. Given that our hypothesis regarding the greater association of hyperarousal cluster symptoms with aggression was based on prior cross-sectional research demonstrating this effect (Elbogen, Wagner, et al., 2010; Savarese et al., 2001; Taft et al., 2007), we attempted to replicate these findings by re-running the model using only baseline measures of both predictor (PTSD cluster scores, age, gender, alcohol use) and outcome (self- and collateral-report of physical aggression) variables. Results of these cross-sectional analyses replicated previous findings: among the three clusters, only hyperarousal cluster symptoms were significant (OR=1.06, $\chi^2=6.98$, $p<.01$).

After controlling for age, gender, alcohol use, and combat exposure, PTSD diagnosis at baseline was associated with increased odds of engaging in at least one act of (self- or collateral-reported) physical aggression over the next 6 months. When hostility was added to the model, the effect of PTSD status was somewhat attenuated, suggesting the possibility that hostility was partially mediating the association of PTSD status and physical aggression (see Table 3). Testing the mediation directly using bootstrapping demonstrated that the indirect effect was significant (95% CI: 0.05 – 0.48), with hostility explaining approximately 25.4% of the association between baseline PTSD status and likelihood of engaging in physical aggression over the next 6 months.

We conducted planned exploratory bivariate analyses to examine which of the 27 cognitions evaluated in the Cook-Medley Hostility Inventory were most strongly associated with physical aggression at 6 months in our sample. While 19 of the 27 items on the inventory were significantly associated with physical aggression at 6 months ($p<.05$), 5 items were found to have significant correlations of $r=.23$ or higher with a p -value $< .0001$, and are thus presented as reflecting the most promising cognitions for further study (see Table 4).

To further explore the relationship of PTSD status, hostility, and risk for engaging in physical aggression, we created 4 “risk” groups based on PTSD status (present/absent) and level of hostility (median split of Ho scores, high/low): No PTSD/Low Hostility (PTSD–/Ho–); No PTSD/High Hostility (PTSD–/Ho+); PTSD/Low Hostility (PTSD+/Ho–); and PTSD/High Hostility (PTSD+/Ho+). We conducted *post-hoc*, exploratory chi-square analyses of group. A chi-square test of all four groups revealed a significant overall effect of group on likelihood of physical aggression at 6 months ($\chi^2=29.22$, $p<.001$). *Post-hoc* chi-square comparisons among the groups indicated that the PTSD+/Ho+ was significantly more likely to engage in physical aggression within 6 months when compared to the PTSD+/Ho– group and to the PTSD–/Ho– group. The PTSD–/Ho+ group did not differ significantly from any of the other groups (See Figure 1).

Discussion

PTSD is associated with aggression in a subset of veterans with PTSD (Jordan et al., 1992; Macmanus et al., 2013; Orth & Wieland, 2006; Sullivan & Elbogen, 2013), but little is known about what distinguish those veterans with PTSD who are aggressive from those who are not. This study tested hypotheses regarding hyperarousal symptoms and hostile cognitions as potential mechanisms of this association in a longitudinal sample of 301 Iraq/Afghanistan era veterans. Broadly, the results suggest that PTSD significantly predicts physical aggression perpetration in veterans, and that hostile cognitions play a key role in mediating this association. While PTSD hyperarousal cluster symptoms were found to be associated with contemporaneous assessment of prior physical aggression, this relationship did not hold in self- or collateral-reports of physical aggression 6 months later.

To our knowledge, this is only longitudinal study to examine mechanisms of the association of PTSD and physical aggression in veterans. Results replicated previous findings (Kubany et al., 1994), indicating that PTSD status is associated with self-reported hostile cognitions as measured by the Cook-Medley Hostility Inventory at baseline. Further, PTSD status at baseline predicted self- and collateral reports of physical aggression at 6-month follow-up, and hostile cognitions partially mediated this association: our findings indicate that PTSD diagnosis at baseline was associated with an odds ratio of 2.11 (CI = 1.23 – 3.63) for physical aggression at 6 months, and that approximately 25% of the variance of this association was explained by hostile cognitions.

Our primary finding that hostile cognitions serve as an important mechanism in the association between PTSD and aggression is consistent with the role cognitions are understood to play in PTSD more generally. For example, Cognitive Processing Therapy (CPT), a trauma-focused treatment for PTSD that is well-supported by research (Monson et al., 2006), targets extreme or unbalanced trauma-related cognitions that maintain PTSD symptoms and guides patients through the process of challenging and modifying these cognitions (Resick, Monson, & Chard, 2010). CPT focuses on five main areas of cognitive distortion common among individuals with PTSD: Safety, trust, power/control, self/other esteem, and intimacy. The current study builds upon this approach to suggest that focused exploration of cognitions associating anger and aggression with survival may be necessary components of anger/aggression management interventions in veterans with PTSD. Anger is an impediment to trauma-focused therapy for PTSD in veterans (Forbes et al., 2008), and it may be that the relative familiarity and accessibility of anger and aggression-related cognitions form a “protective barrier” from more vulnerable emotions like shame and grief (Gerlock, 1994). Gaining skills to understand and challenge these cognitions, as well as gaining insight into how anger and aggression-related cognitions may mask those associated with more vulnerable emotions, may be a necessary first step to accessing the broader spectrum of emotions required by trauma-focused therapy.

Our findings may help explain some of the heterogeneity in the presentation of PTSD and other stress-related disorders among trauma survivors (Krueger & Markon, 2006). Recent findings have suggested that after a traumatic event unique cognitive biases may be differentially associated with specific psychopathology outcomes such as specific phobia,

depression, or PTSD, and that these cognitions may have predictive power even after accounting for established predictors such as number of past traumas and social support (Ehring, Ehlers, & Glucksman, 2008). The data presented here are consistent with such findings, and suggest that even within the diagnosis of PTSD the content of cognitive distortions may critically influence the nature of functional impairment.

Finally, while some of the cognitions observed to be most strongly predictive of aggression in this sample clearly reflected PTSD-related cognitive distortions (i.e. “It is safer to trust nobody”), others that reflected overvaluing of aggression as an acceptable approach to managing interpersonal interactions (i.e. “When people do me wrong, I feel I should pay them back if I can, just for the principle of the thing”; “I have at times had to be rough with people who were rude or annoying”). Research has observed high rates of violence in subcultures with strong culturally-sanctioned beliefs related to “honor” and “respect”. Such “honor cultures” have been documented among Caucasians in the American South (Brown, Imura, & Mayeux, 2014), and a similar construct has been described among highly disenfranchised youth in inner city African-American neighborhoods (Anderson, 1999). In communities with high rates of violence, failure to respond aggressively to provocation or “disrespect” may invite further victimization and thus retaliation is seen as a means of reducing future threat (Stewart & Simons, 2010). Such social contexts may have broad effects on the individual: Compared to males in non-honor cultures, males in honor cultures who perceive they have been insulted are more likely to demonstrate increases in testosterone levels, to become cognitively primed for aggression, and to engage in aggressive and dominant behavior (Cohen, Nisbett, Bowdle, & Schwarz, 1996).

Honor and respect are highly valued characteristics within military culture, and the rationale behind this code may be similar to that justifying the honor code of violent civilian communities: Roles are clearly defined in the military by rank, and respect from subordinates is essential to effective leadership because refusal to follow orders can result in loss of life. As such, the concept of a “culture of honor” may be an area for future research in the cognitive schemas that contribute to aggression in both military veterans and in civilian communities that routinely contend with violence. Aggression may be more likely in both males and females with PTSD who have internalized this aspect of military (or street) culture because of their increased sensitization to perceived affronts to their “honor”, and greater valuation of aggression as an acceptable (or even expected) response in such situations. Further, interventions to address aggression in these populations may need to frame participation in a way that allows participants to maintain the sense of respect and honor that is so critical to identity within the group.

Limitations and Future Directions

These findings presented here should be considered in light of its limitations. First, the partial mediation of the association between PTSD and physical aggression by hostile cognitions accounted for slightly more than 25% of the variance in this sample. While this is a clinically meaningful effect, the larger portion of the variance that remains unexplained suggests that there are other key factors in the association. There may be some important social and policy implications of our findings that the individual-level cognitive construct of

“hostility” explains only about a quarter of the variance in what is likely to be a complex association between PTSD and aggression in veterans. Research has clearly demonstrated that contextual factors including insufficient income to cover basic needs, homelessness, and unemployment increase violence risk among veterans (Elbogen, Fuller, et al., 2010). As such, balanced consideration of all relevant contextual variables, particularly when evaluating research focused on “person-centered” predictors of violence, is essential to prevent misinterpretation of findings that could result in stigmatization or “victim-blaming” of individuals with PTSD.

Other clinical variables might also account for meaningful variance if added to the model. For example, we did not include depression in the model because it has not as reliably been associated with aggression as male gender, combat, and substance abuse (Elbogen et al., 2014), factors that we did include. However, a recent paper by Flory and Yehuda (2015) suggests that while depression and other “internalizing” disorders may not necessarily provide a direct link between aggression and PTSD, they may nevertheless be important constructs in a more nuanced understanding of the relationship. Specifically, based on epidemiological and biological research of the comorbidity of depression and PTSD, these authors postulate that varying patterns of PTSD comorbidity may reflect “phenotypes” that could differ on behavioral outcomes such as aggressive behavior. That is, individuals with an “internalizing” personality style (characterized by low affectivity and low positive affectivity) may at increased risk for developing PTSD comorbid with depression in response to trauma exposure, whereas those with an “externalizing” personality style (characterized by low affectivity and low constraint) may be more likely to develop PTSD comorbid with substance abuse and aggression (Flory & Yehuda, 2015). The field may benefit from future research examining how cognitive variables such as hostility interact with comorbid depression vs. substance abuse to predict aggressive outcomes in both veterans and non-veterans.

A second limitation of this study is that, in terms of mechanisms, our relatively small sample does not allow us to conclusively rule out the possibility that hyperarousal cluster symptoms contribute to risk for future aggression. In fact, some preliminary evidence of such an effect has recently been reported in a study of the effectiveness of integrated treatment for substance use disorders and PTSD in civilians (Barrett, Teesson, & Mills, 2014). Given that we also did not find alcohol use to significantly predict aggression in our final model, it is possible that our negative results reflect the complexity of the relationship among hyperarousal, alcohol use, and physical aggression (Savarese et al., 2001), rather than the absence of an effect. Future studies using larger samples should examine this possibility.

Third, while our outcome measure of physical aggression included both veteran and collateral report and so is stronger than most outcome measures used in studies up to this point, future research would benefit from a more thorough integration of these sources with objective data such as police, employment, and medical records. This resource-intensive approach has rarely been used in violence risk assessment research (see (Monahan et al., 2001) for a notable exception), but it would nonetheless provide important protection from retrospective reporting bias, and from bias associated with reluctance to report undesirable behavior. A final limitation of this work is that the sample was not representative of all

veterans who have served in the military since September 11, 2001: The majority of the veterans who participated in this study were enrolled in the VA, making this a largely treatment-seeking sample.

While anger management groups are offered at most Veterans Affairs (VA) hospitals, Community Based Outpatient Clinics, and Vet Centers, the effectiveness of anger management therapy for veterans with PTSD in reducing aggressive behavior has been examined in only one randomized controlled trial to date (Chemtob et al., 1997). Consistent with our findings of the role of hostile cognitions in the association of PTSD and aggression, Chemtob and colleagues (1997) found support for the effectiveness of their cognitive-behavioral approach (vs. waitlist) in reducing aggression over eighteen months in a sample of 15 veterans. However, a great deal of work remains to be done to evaluate the effectiveness of group approaches to anger management, as well as to determine appropriate targeting and sequencing of such treatment.

Our findings that hostile cognitions predict aggressive behavior in veterans with PTSD extends previous research demonstrating that trauma-related cognitive distortions both directly and indirectly predict PTSD symptom severity (O'Donnell, Elliott, Wolfgang, & Creamer, 2007). Building upon this work, recent research has also begun to confirm that changes to trauma-related cognitions are causally associated with symptom improvement in cognitive therapy for PTSD (Iverson, King, Cunningham, & Resick, 2015). In a similar vein, future research in the treatment of trauma and aggression should investigate whether cognitive therapy for anger and aggression in veterans with PTSD leads to changes in hostile cognitions, and if so, whether such changes result in reductions in aggressive behavior.

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References

- Anderson, E. Code of the Street: Decency, Violence, and the Moral Life of the Inner City. New York, NY: W.W. Norton and Company, Inc; 1999.
- APA. Diagnostic and Statistical Manual of Mental Disorders. 5. Arlington, VA: American Psychiatric Association; 2013.
- Barefoot JC, Dodge KA, Peterson BL, Dahlstrom WG, Williams RB Jr. The Cook-Medley hostility scale: Item content and ability to predict survival. *Psychosomatic Medicine*. 1989; 51(1):46–57. [PubMed: 2928460]
- Barrett EL, Teesson M, Mills KL. Associations between substance use, post-traumatic stress disorder and the perpetration of violence: A longitudinal investigation. *Addictive Behaviors*. 2014; 39(6): 1075–1080. DOI: 10.1016/j.addbeh.2014.03.003 [PubMed: 24656999]
- Biddle D, Elliott P, Creamer M, Forbes D, Devilly GJ. Self-reported problems: a comparison between PTSD-diagnosed veterans, their spouses, and clinicians. *Behaviour Research and Therapy*. 2002; 40(7):853–865. [PubMed: 12074378]
- Blake DD, Weathers FW, Nagy LM, Kaloupek DG, Gusman FD, Charney DS, Keane TM. The development of a Clinician-Administered PTSD Scale. *Journal of Traumatic Stress*. 1995; 8(1):75–90. [PubMed: 7712061]

- Brown RP, Imura M, Mayeux L. Honor and the Stigma of Mental Healthcare. *Personality & Social Psychology Bulletin*. 2014; 40(9):1119–1131. DOI: 10.1177/0146167214536741 [PubMed: 24854479]
- Chemtob CM, Novaco RW, Hamada RS, Gross DM. Cognitive-behavioral treatment for severe anger in posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology*. 1997; 65(1):184–189. [PubMed: 9103748]
- Cohen D, Nisbett RE, Bowdle BF, Schwarz N. Insult, aggression, and the southern culture of honor: an “experimental ethnography”. *Journal of Personality and Social Psychology*. 1996; 70(5):945–959. [PubMed: 8656339]
- Cook WW, Medley DM. Proposed hostility and Pharisaic-virtue scales for the MMPI. *Journal of Applied Psychology*. 1954; 39:123–129.
- Ehring T, Ehlers A, Glucksman E. Do cognitive models help in predicting the severity of posttraumatic stress disorder, phobia, and depression after motor vehicle accidents? A prospective longitudinal study. *Journal of Consulting and Clinical Psychology*. 2008; 76(2):219–230. DOI: 10.1037/0022-006x.76.2.219 [PubMed: 18377119]
- Elbogen EB, Fuller S, Johnson SC, Brooks S, Kinneer P, Calhoun PS, Beckham JC. Improving risk assessment of violence among military veterans: an evidence-based approach for clinical decision-making. *Clinical Psychology Review*. 2010; 30(6):595–607. S0272-7358(10)00049-8 [pii]. DOI: 10.1016/j.cpr.2010.03.009 [PubMed: 20627387]
- Elbogen EB, Johnson SC. The intricate link between violence and mental disorder: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry*. 2009; 66(2):152–161. 66/2/152 [pii]. DOI: 10.1001/archgenpsychiatry.2008.537 [PubMed: 19188537]
- Elbogen EB, Johnson SC, Wagner HR, Sullivan C, Taft CT, Beckham JC. Violent behaviour and post-traumatic stress disorder in US Iraq and Afghanistan veterans. *British Journal of Psychiatry*. 2014; 204:368–375. DOI: 10.1192/bjp.bp.113.134627 [PubMed: 24578444]
- Elbogen EB, Wagner HR, Fuller SR, Calhoun PS, Kinneer PM, Beckham JC. Correlates of anger and hostility in Iraq and Afghanistan war veterans. *American Journal of Psychiatry*. 2010; 167(9):1051–1058. appi.ajp.2010.09050739 [pii]. DOI: 10.1176/appi.ajp.2010.09050739 [PubMed: 20551162]
- Forbes D, Parslow R, Creamer M, Allen N, McHugh T, Hopwood M. Mechanisms of anger and treatment outcome in combat veterans with posttraumatic stress disorder. *Journal of Traumatic Stress*. 2008; 21(2):142–149. DOI: 10.1002/jts.20315 [PubMed: 18404639]
- Gerlock AA. Veterans’ responses to anger management intervention. *Issues in Mental Health Nursing*. 1994; 15(4):393–408. [PubMed: 8056569]
- Grossman, D. *On Killing: The Psychological Cost of Learning to Kill in War and Society*. 1. New York, NY: Back Bay Books; 1995.
- Han K, Weed NC, Calhoun RF, Butcher JN. Psychometric characteristics of the MMPI-2 Cook-Medley Hostility scale. *Journal of Personality Assessment*. 1995; 65(3):567–585. DOI: 10.1207/s15327752jpa6503_15 [PubMed: 16367714]
- Holtzworth-Munroe A, Hutchinson G. Attributing negative intent to wife behavior: the attributions of maritally violent versus nonviolent men. *Journal of Abnormal Psychology*. 1993; 102(2):206–211. [PubMed: 8315133]
- Iverson KM, King MW, Cunningham KC, Resick PA. Rape survivors’ trauma-related beliefs before and after Cognitive processing therapy: associations with PTSD and depression symptoms. *Behaviour Research and Therapy*. 2015; 66:49–55. DOI: 10.1016/j.brat.2015.01.002 [PubMed: 25698164]
- Jordan BK, Marmar CR, Fairbank JA, Schlenger WE, Kulka RA, Hough RL, Weiss DS. Problems in families of male Vietnam veterans with posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology*. 1992; 60(6):916–926. [PubMed: 1460153]
- Keane TM, Fairbank JA, Caddell JM, Zimering RT, Taylor KL, Mora CA. Clinical evaluation of a measure to assess combat exposure. *Psychological Assessment: A Journal of Consulting and Clinical Psychology*. 1989; 1(1):53–55.

- Krueger RF, Markon KE. Understanding Psychopathology: Melding Behavior Genetics, Personality, and Quantitative Psychology to Develop an Empirically Based Model. *Current Directions in Psychological Science*. 2006; 15(3):113–117. [PubMed: 18392116]
- Kubany ES, Gino A, Denny NR, Torigoe RY. Relationship of cynical hostility and PTSD among Vietnam veterans. *Journal of Traumatic Stress*. 1994; 7(1):21–31. [PubMed: 8044439]
- Macmanus D, Dean K, Jones M, Rona RJ, Greenberg N, Hull L, ... Fear NT. Violent offending by UK military personnel deployed to Iraq and Afghanistan: a data linkage cohort study. *Lancet*. 2013; 381(9870):907–917. DOI: 10.1016/S0140-6736(13)60354-2 [PubMed: 23499041]
- Milliken CS, Auchterlonie JL, Hoge CW. Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq war. *JAMA*. 2007; 298(18):2141–2148. 298/18/2141 [pii]. DOI: 10.1001/jama.298.18.2141 [PubMed: 18000197]
- Monahan, J.; Steadman, HJ.; Silver, E.; Appelbaum, PS.; Robbins, PC.; Mulvey, EP.; ... Banks, S. *Rethinking Risk Assessment: The MacArthur Study of Mental Disorder and Violence*. New York: Oxford University Press; 2001.
- Monson CM, Schnurr PP, Resick PA, Friedman MJ, Young-Xu Y, Stevens SP. Cognitive processing therapy for veterans with military-related posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology*. 2006; 74(5):898–907. 2006-13014-011 [pii]. DOI: 10.1037/0022-006X.74.5.898 [PubMed: 17032094]
- O'Donnell ML, Elliott P, Wolfgang BJ, Creamer M. Posttraumatic appraisals in the development and persistence of posttraumatic stress symptoms. *Journal of Traumatic Stress*. 2007; 20(2):173–182. DOI: 10.1002/jts.20198 [PubMed: 17427908]
- Orth U, Wieland E. Anger, hostility, and posttraumatic stress disorder in trauma-exposed adults: a meta-analysis. *Journal of Consulting and Clinical Psychology*. 2006; 74(4):698–706. 2006-09621-007 [pii]. DOI: 10.1037/0022-006X.74.4.698 [PubMed: 16881777]
- Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*. 2008; 40(3):879–891. [PubMed: 18697684]
- Reinert DF, Allen JP. The alcohol use disorders identification test: an update of research findings. *Alcoholism, Clinical and Experimental Research*. 2007; 31(2):185–199. DOI: 10.1111/j.1530-0277.2006.00295.x
- Resick, PA.; Monson, CM.; Chard, KM. *Cognitive processing therapy: Veteran/military version: Therapist's manual*. Washington, DC: Department of Veterans Affairs; 2010.
- Rodriguez P, Holowka DW, Marx BP. Assessment of posttraumatic stress disorder-related functional impairment: A review. *The Journal of Rehabilitation Research and Development*. 2012; 49(5): 649.doi: 10.1682/jrrd.2011.09.0162 [PubMed: 23015577]
- Savarese VW, Suvak MK, King LA, King DW. Relationships among alcohol use, hyperarousal, and marital abuse and violence in Vietnam veterans. *Journal of Traumatic Stress*. 2001; 14(4):717–732. DOI: 10.1023/A:1013038021175 [PubMed: 11776419]
- Sayer NA, Noorbaloochi S, Frazier P, Carlson K, Gravely A, Murdoch M. Reintegration problems and treatment interests among Iraq and Afghanistan combat veterans receiving VA medical care. *Psychiatric Services*. 2010; 61(6):589–597. 61/6/589 [pii]]><![CDATA[. DOI: 10.1176/appi.ps.61.6.589 [PubMed: 20513682]
- Soldatos CR, Kales JD, Scharf MB, Bixler EO, Kales A. Cigarette smoking associated with sleep difficulty. *Science*. 1980; 207(4430):551–553. [PubMed: 7352268]
- Steadman HJ, Silver E, Monahan J, Appelbaum PS, Robbins PC, Mulvey EP, ... Banks S. A classification tree approach to the development of actuarial violence risk assessment tools. *Law and Human Behavior*. 2000; 24(1):83–100. [PubMed: 10693320]
- Steiner M, Streiner DL, Steinberg S, Stewart D, Carter D, Berger C, ... Grover D. The measurement of premenstrual mood symptoms. *Journal of Affective Disorders*. 1999; 53(3):269–273. S0165032798001219 [pii]. [PubMed: 10404713]
- Stewart EA, Simons RL. RACE, CODE OF THE STREET, AND VIOLENT DELINQUENCY: A MULTILEVEL INVESTIGATION OF NEIGHBORHOOD STREET CULTURE AND INDIVIDUAL NORMS OF VIOLENCE. *Criminology; an interdisciplinary journal*. 2010; 48(2): 569–605. DOI: 10.1111/j.1745-9125.2010.00196.x

- Straus M. Measuring intrafamily conflict and violence: The Conflict Tactics Scales. *Journal of Marriage and the Family*. 1979; 41:75–88.
- Sullivan CP, Elbogen EB. PTSD symptoms and family versus stranger violence in Iraq and Afghanistan veterans. *Law and Human Behavior*. 2013; doi: 10.1037/lhb0000035
- Taft C, Kaloupek D, Schumm J, Marshall A, Panuzio J, King D, Keane T. Posttraumatic stress disorder symptoms, physiological reactivity, alcohol problems, and aggression among military veterans. *Journal of Abnormal Psychology*. 2007; 116(3):498–507. 2007-11737-007 [pii]. DOI: 10.1037/0021-843X.116.3.498 [PubMed: 17696706]
- Thomas JL, Wilk JE, Riviere LA, McGurk D, Castro CA, Hoge CW. Prevalence of mental health problems and functional impairment among active component and National Guard soldiers 3 and 12 months following combat in Iraq. *Archives of General Psychiatry*. 2010; 67(6):614–623. 67/6/614 [pii]. DOI: 10.1001/archgenpsychiatry.2010.54 [PubMed: 20530011]
- Weathers FW, Keane TM, Davidson JR. Clinician-administered PTSD scale: a review of the first ten years of research. *Depression and Anxiety*. 2001; 13(3):132–156. [pii]. DOI: 10.1002/da.1029 [PubMed: 11387733]
- Hayes, AF. SAS PROCESS macro (Software). 2012. Available from: <http://www.processmacro.org/>

Figure 1. Percentage of each risk group endorsing at least one act of physical aggression over the 6-month follow up period. Asterisk (*) reflects a significant difference at $\alpha < .05$.

Table 1

Demographic and clinical characteristics

Demographic/Clinical characteristic	Mean (SD) or percent of sample
Age (<i>n</i> =288)	39.55 (10.67)
% female (<i>n</i> =287)	17.4%
% African-American (<i>n</i> =61)	44%
% White (<i>n</i> =57)	41%
% Other race (<i>n</i> =21)	15%
Years of education	14.34 (2.16)
Employed (part/full time) (<i>n</i> =287)	65.8%
% with PTSD (<i>n</i> =275)	50%
Combat Exposure Scale (<i>n</i> =284)	11.39 (10.59)
AUDIT score (<i>n</i> =287)	4.92 (6.21)
Cook-Medley Total score (<i>n</i> =289)	15.03 (5.07)

Table 2

Bivariate associations of baseline predictors and physical aggression at 6 months

	Not Aggressive	Aggressive	test statistic	Odds Ratio (95% CI)
Age (n=283)	40.58 (10.64)	37.95 (10.58)	t=2.05 *	
Gender (n=287)				
% of female sample	60.0%	40.0%	p=0.87	.951 (0.51–1.77)
% of male sample	61.2%	38.8%		
AUDIT total (n=287)	4.44 (6.21)	5.66 (6.17)	p=0.10	
Combat Exposure Scale (n=284)	9.50 (9.97)	14.33 (10.90)	t=−3.84 ***	
Cook-Medley Total (n=289)	13.91 (4.87)	16.78 (4.90)	t=−4.89 ***	
PTSD status (n=275)				
% with PTSD diagnosis	47.5%	52.6%	X ² =15.82 ***	2.71 (1.65–4.46)
% without PTSD diagnosis	71.0%	29.0%		
CAPS cluster scores (n=275)				
re-experiencing	8.01 (9.41)	12.63 (9.84)	t=−3.93 ***	
avoidance/numbing	12.84 (12.69)	20.17 (13.99)	t=−4.51 ***	
Hyper-arousal	12.52 (10.83)	18.99 (10.51)	t=−4.93 ***	

*Note.**
 $p<0.05$.**
 $p<0.01$.***
 $p<0.001$.

Regression Models of PTSD at Baseline Predicting Physical Aggression at Six Months, With and Without Cook Medley Hostility Total Score (N = 269)

TABLE 3

Parameter	Standardized Estimate (β)	Odds Ratio
PTSD only		
Age	-0.07	0.99 (0.96–1.01)
Gender (0 = female, 1 = male)	0.05	1.27 (0.64–2.54)
AUDIT total	0.02	1.01 (0.96–1.05)
Combat Exposure Scale	0.16*	1.03 (1.00–1.06)
PTSD status	0.21**	2.11 (1.23–3.63)
PTSD and Hostility		
Age	-0.06	0.99 (0.97–1.02)
Gender (0 = female, 1 = male)	0.06	1.36 (0.67–2.76)
AUDIT total	-0.02	1.00 (0.95–1.04)
Combat Exposure Scale	0.11	1.02 (0.99–1.05)
PTSD status	0.16*	1.78 (1.02–3.12)
Cook Medley Hostility	0.26**	1.10 (1.30–1.17)

* p < .05,

** p < .01

Table 4

Hostility items most highly correlated with physical aggression over 6-month follow-up (N=269)

Item	Pearson <i>r</i>
# 14: It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.	0.27 ***
#19: When people do me wrong, I feel I should pay them back if I can, just for the principle of the thing.	0.27 ***
#8: It is safer to trust nobody.	0.26 ***
#17: I am not easily angered (<i>reverse scored</i>).	-0.25 ***
#24: I have at times had to be rough with people who were rude or annoying.	0.23 ***

 $p < .0001$.