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Aggressive Driving in Iraq and Afghanistan Veterans: Association with Posttraumatic Stress Disorder and Traumatic Brain Injury

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Abstract

Purpose—Aggressive driving contributes to the high rates of post-deployment motor vehicle-related injury and death observed among veterans, and veterans cite problems with anger, aggressive driving, and road rage as being among their most pressing driving-related concerns. Both posttraumatic stress disorder (PTSD) and traumatic brain injury (TBI) have been associated with driving-related deficits in treatment-seeking samples of veterans, but the relative contribution of each of these conditions to problems with aggressive driving in the broader population of combat veterans is unclear.

Method—Chi-square and logistic regression analyses were used to examine the relative association of PTSD, TBI, and co-occurring PTSD and TBI to self-reported problems with road rage in a sample of 1102 veterans living in the mid-Atlantic region of the United States who had served in Afghanistan or Iraq.

Results—Results indicate that controlling for relevant demographic variables, PTSD without TBI (*OR*=3.44, $p<.001$), and PTSD with co-occurring TBI (*OR*=4.71, $p<.001$) were associated with increased risk of road rage, but TBI without PTSD was not.

Conclusions—Our findings suggest that PTSD, with or without comorbid TBI, may be associated with increased risk of aggressive driving in veterans. Clinical implications for treating problems with road rage are discussed, including use of interventions targeting hostile interpretation bias and training in emotional and physiological arousal regulation skills.

Keywords

military; aggression; OEF/OIF; road rage

Motor vehicle accidents (MVA) are among the highest post-deployment causes of injury and death in veterans (Krahl, Jankosky, Thomas, & Hooper, 2010; Lew et al., 2011; Woodall,

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Jacobson, & Crum-Cianflone, 2014). In Gulf War veterans, MVA-related deaths were observed to increase dramatically immediately post-deployment, spiking to over 10 per 100,000 persons within the first full quarter, compared to under 4 per 100,000 persons in non-deployed veterans during that time frame (Lincoln et al., 2006). More recently, insurance records reveal that veterans of the wars in Iraq or Afghanistan have a 13% increase in at-fault motor vehicle accidents from 6 months pre- to 6 months post-deployment (United States Automobile Association, 2012; Woodall et al., 2014). A recent meta-analysis of 51 studies found that driver anger is associated with increased incidence of near misses and accidents (Zhang & Chan, 2016), and one recent study found that more than 30% of recently deployed Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) veterans reported significantly elevated levels of anger and aggressive driving behaviors as compared to the general population (Hwang, Peyton, Kim, Nakama-Sato, & Noble, 2014). Accidents are not the only adverse consequence of high levels of driving-related anger in combat veterans: In one sample of recently deployed OEF/OIF veterans, over one quarter of respondents reported that they "seek a personal encounter with a bad driver" at a rate of "sometimes", "often", or "always" (Hwang et al., 2014). Not surprisingly, veterans in treatment seeking samples cite problems with anger, aggressive driving, and road rage as being among their most pressing driving-related concerns (Hannold, Classen, Winter, Lanford, & Levy, 2013; Lew et al., 2011; Strom et al., 2013).

There are multiple factors that may contribute to aggressive driving in this population. First, military personnel who served in Iraq or Afghanistan were trained to employ aggressive, life-saving "battlemind" driving tactics that include speeding, swerving around road hazards, straddling the center line, and ignoring traffic signs (Amick, Kraft, & McGlinchey, 2013; Hannold et al., 2013; Lew, Amick, Kraft, Stein, & Cifu, 2010). Second, traumatic brain injury (TBI) and posttraumatic stress disorder (PTSD)[1] are common among OEF/OIF veterans, and each has been found to be associated with increased incidence of aggressive driving (Ilie et al., 2015; Kuhn, Drescher, Ruzek, & Rosen, 2010; T. Q. Strom et al., 2012). Both conditions are characterized by cognitive functioning deficits (attention lapses, executive functioning, processing speed) and emotion regulation problems (irritability, impulsivity, anxiety) that can make it difficult to override impulsive or aggressive reactions to perceived threat or provocation by other drivers (Amick et al., 2013; Classen et al., 2009; Classen et al., 2011; Contractor, Armour, Forbes, & Elhai, 2016; Lew et al., 2010; Lew et al., 2011; Wickens, Toplak, & Wiesenthal, 2008). The same deficits may also make it particularly challenging to inhibit overlearned combat driving behaviors and readjust to a less aggressive civilian style of driving (Hannold et al., 2013).

TBI and PTSD are highly comorbid in combat veterans, and there is evidence that the persistent "postconcussive" symptoms associated with TBI may be largely mediated by PTSD in those with both conditions (Hoge et al., 2008; Schneiderman, Braver, & Kang, 2008). Driving simulation studies have found that combat veterans perform more poorly than controls on a number of driving-related indices (Amick et al., 2013; Classen et al.,

[1]Rates of TBI, for example, have been reported to be as high as 15% in veterans of the Iraq War (Hoge et al., 2008), and rates of PTSD have been found to be close to 16% of veterans who were deployed to Iraq or Afghanistan (Dursa, Reinhard, Barth, & Schneiderman, 2014).

2011), and that PTSD may be associated with increases in driving errors (Amick et al., 2013). In one study of Iraq/Afghanistan era veterans seen in a VA outpatient polytrauma clinic where 93% of patients endorsed difficulties with driving in at least one domain (e.g. general driving difficulties, receipt of a warning or traffic citation, accidents, near misses, problems with anger or impatience, or becoming lost or disoriented), patients with PTSD (with or without TBI) reported the most significant driving impairments, while veterans with TBI alone did not differ from veterans without either diagnosis in the types of driving problems they experienced. Problems with anger or impatience, specifically, was endorsed by over 80% of veterans with PTSD, regardless of the presence of TBI (Lew et al., 2011).

The majority of research examining difficulties with aggressive driving or road rage among OEF/OIF veterans has been conducted in veterans who obtain healthcare through the Department of Veterans Affairs (VA) (Hannold et al., 2013; James, Strom, & Leskela, 2014; Kuhn et al., 2010; T. Strom et al., 2013; T. Q. Strom et al., 2012), a subset of the veteran population with the greatest and most complex mental health needs (CMS Alliance to Modernize Healthcare, 2015). In this study we sought to examine the association between combat exposure, TBI, PTSD, and perceived need to reduce aggressive driving or road rage in a large sample of OEF/OIF veterans that included both VA users and non-users. We hypothesized that (1) veterans using VA healthcare services would be more likely to report difficulties with road rage and (2) that PTSD would be associated with perceived need to cut down on aggressive driving in this population, regardless of the presence of TBI.

Method

Participants and Procedure

Approvals for the parent project for this study were obtained from the [edited out for blind review] Institutional Review Board and the U.S. Office of Management and Budget. Details of study methods have been published previously [edited out for blind review] and will be reviewed only briefly here. Measures for this study were completed as part of the OEF/OIF Veterans Health and Needs Study. This study surveyed a random sample of 5000 veterans who deployed in support of the wars in Iraq and Afghanistan, were eligible for VA care, and who had a last known residence within the Veterans Integrated Service Network 6 (VISN 6) catchment area (North Carolina, most of Virginia, and the southeastern corner of West Virginia). Potentially eligible participants were identified in collaboration with the Defense Manpower Data Center. A modified Dillman procedure was used, in which all participants received a 60-item survey package including an informed consent form. If needed, a follow-up letter and duplicate survey were sent. Of the 5000 veterans identified, 72 (1.4%) were determined to be ineligible (e.g., deceased or deployed) and 924 (18.5%) surveys were undeliverable (returned to sender). Of the 4004 surveys that were delivered, 1161 surveys were completed and returned, resulting in a cooperation rate of 29.0% (response rate of 23.6%).

Measures

Survey items assessed demographic characteristics and military history, including age, sex, race, marital status, employment status, military component and rank. “Road rage” was

assessed via the following dichotomously scored item: “In the past year, have you felt you wanted or needed to cut down on aggressive driving or ‘road rage?’” Use of VA services for health care was assessed via the following item: “Since your last deployment, which, if any, have you used? Mark all that apply: used VA for health care services; used non-VA for health care services; have not used any health care services.” The Combat Experiences Scale (Hoge et al., 2004) was used to assess exposure to combat-related trauma. Participants indicated whether they had experienced 17 different combat situations during their deployment(s) such as “Handling or uncovering human remains”, “Participating in demeaning operations”, or “Had a buddy shot or hit who was near you.” Items endorsed were summed to index the total number of types of combat trauma experienced, ranging from 0–17.

PTSD symptom severity in the month prior to completing the survey was assessed using the 17-item PTSD Checklist (PCL) (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). Items on the PCL correspond to the diagnostic criteria for PTSD in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision. Total score is the sum of all items and can range from 17–85. Consistent with previous research, scores of 50 and above on the PCL were considered to reflect “probable PTSD” (Crawford et al., 2015; Forbes, Creamer, & Biddle, 2001; Hoge et al., 2008; Schry et al., 2015).

Potential TBI was coded as present if a participant indicated that he or she met both of the following criteria: 1) sustained an injury during deployment such as fragment wound, bullet wound, vehicle accident (tank, boat, plan, etc.), fall, blast/explosion (IED, RPG, land mine, grenade, etc.), physical training/sports, or other; and 2) the injury resulted in loss of consciousness as evidenced by “being dazed, confused, or seeing stars”; loss of consciousness for “less than 1 minute”, “1 to 20 minutes”, or “longer than 20 minutes”; or “not remembering the injury”. If both of these criteria were not met, the participant was coded as not having sustained a head injury.

Analyses

Participants were excluded iteratively from analysis if they were missing data necessary to calculate presence/absence of road rage (n=34 excluded), gender data (n=5 excluded), or more than 3 items on the PCL (n=20 excluded), reducing the total sample size for these analyses from 1161 to 1102. For participants missing 3 or fewer items on the PCL, the mean item rating for the symptom cluster of the missing item was imputed. For the remaining demographic and military variables included as covariates, multiple imputation with 10 iterations was used to impute missing data. Results from the pooled data are reported in this article.

Chi-square analyses were used to examine the differences on endorsement of road rage among the four possible TBI/PTSD participant groups: neither TBI nor PTSD; TBI without PTSD; PTSD without TBI; both TBI and PTSD. To test the hypothesis that veterans using VA healthcare services would be more likely to report difficulties with road rage, a logistic regression was used to model the univariate association between use of VA services and self-reported road rage. To evaluate the hypothesis that PTSD would be associated with self-reported road rage, regardless of the presence of TBI, a multivariate logistic regression

modeled the presence of road rage as a factor of age, minority status (white vs. non-white), gender, martial status (married vs. unmarried), rank structure (officer vs. enlisted), number of types of combat traumas experience (0-17), and PTSD/TBI status (TBI only, PTSD only, or both TBI and PTSD; referent category=neither TBI nor PTSD).

Results

Demographic and clinical characteristics are reported in Table 1. A chi-square test of all four groups revealed a significant overall effect of group on likelihood of endorsing road rage (χ^2=109.62, p<.0001). Post-hoc chi-square comparisons among the groups indicated that both groups with PTSD (regardless of TBI status) reported significantly (i.e. p<.05) higher rates of road rage when compared to the group with neither PTSD nor TBI, and when compared to the group with TBI only. The group with TBI only did not endorse significantly higher rates of road rage than the group with neither PTSD nor TBI (See Figure 1).

In the logistic regression modeling road rage as a factor of VA use only, veterans who reported using VA services since their last deployment were significantly more likely to report problems with self-reported aggressive driving or road rage (odds ratio [*OR*]=1.87, p<.0001) than veterans who did not report using VA services. In the multivariate logistic regression model, age (*OR*=0.98, p<.05), officer status (*OR*=0.57, p<.01), combat trauma (*OR*=1.09, p<.0001), PTSD without TBI (*OR*=3.63, p<.0001), and PTSD comorbid with TBI (*OR*=5.01, p<.0001) were significantly associated with road rage, whereas TBI without PTSD was not. Notably, use of VA services was no longer associated with road rage in the multivariate model (see Table 2). To examine whether the PCL cutoff score used to determine the presence of probable PTSD influenced the results of the regression, we re-ran the model with the threshold for PTSD at PCL≥40 and PCL≥60. The results were not changed substantially in either model.

Discussion

In this sample of both VA and non-VA service-using veterans, we found that 56% of veterans with PTSD, and 70% of veterans with both PTSD and TBI, endorsed a recognized need to cut down on aggressive driving. In bivariate analyses, use of VA services was significantly associated with self-reported difficulty controlling aggressive driving or “road rage”; however, this association was no longer significant in the multivariate model, suggesting that observed differences in problems with aggressive driving between users and non-users of VA services were largely accounted for by demographic and clinical factors.

Veterans with PTSD, regardless of TBI status, reported road rage at significantly higher rates compared to veterans with TBI only, and compared to veterans with neither TBI nor PTSD. Veterans with TBI only did not differ from those with neither diagnosis in self-reported problems with road rage. From a clinical standpoint, this suggests that treatment of PTSD could benefit from assessment of aggressive driving and the inclusion of aggressive driving as an outcome in treatment plans. Interventions for road rage in veterans with PTSD (regardless of TBI status) might be strengthened by components that focus on motivational enhancement, target hostile interpretation biases (e.g. Hawkins & Cougle, 2013), or enhance

emotional and physiological arousal regulation skills. A previous study of this cohort documented that 57% of veterans with probable PTSD reported at least one mental health contact in the prior 12-months, and 68% of those reporting any mental health contact indicated that services were obtained at a VA or Vet Center (Crawford et al., 2015). Outreach to the more than 40% of Veterans with probable PTSD is needed, as is additional research on whether PTSD treatment lowers risk of road rage/aggressive driving.

Apart from PTSD, TBI and exposure to combat trauma, officer status emerged as a significant (negative) predictor of aggressive driving in the multivariate model. Officer status has been found to be protective against both PTSD (Ramchand, Rudavsky, Grant, Tanielian, & Jaycox, 2015) and aggression (Gallaway, Fink, Millikan, & Bell, 2012) in previous work, with hypothesized mechanisms including older age, higher education, and lower combat exposure. Bivariate analyses in the current sample indicated that officer status was positively associated with age, but was not related to number of combat-related traumas. Enlisted status and exposure to combat trauma were significantly associated with increased odds of aggressive driving. This is consistent with previous findings that enlisted status and higher rates of deployment-related traumatic events are associated with higher levels of risky driving behavior and greater risk of involvement in motor vehicle accidents (Hoggatt et al., 2015; Woodall et al., 2014). As such, post-deployment education aimed at helping military personnel transition from battlemind-style aggressive driving behaviors to the more defensive approach appropriate to civilian settings may be warranted.

These findings extend previous work in at least two ways. First, the majority of prior research on aggressive driving in OEF/OIF veterans has been in users of VA healthcare (see Hwang et al., 2014, for an exception), a subset of veterans with the greatest and most complex mental health needs (CMS Alliance to Modernize Healthcare, 2015). Our sample extends these findings to include veterans who are not actively seeking healthcare through the VA, allowing us to demonstrate that while VA use is associated with increased road rage in bivariate analysis, this association does not hold when other relevant demographic and clinical factors are taken into consideration.

This study also adds to the literature on post-deployment driving problems by demonstrating that PTSD, regardless of TBI status, is associated specifically with aggressive driving. This may be important because aggressive driving appears to be unique among driving-related challenges in combat veterans. For example, Hannold et al (2013) found that OEF/OIF veterans sought to implement specific strategies to mitigate most of their driving-related difficulties, with the notable exception of aggressive driving. Individuals with PTSD have been found to be more likely to perceive threat and to attribute hostile intentions to perceived provocation by others (Dodge, Bates, & Pettit, 1990; Taft et al., 2015), and PTSD-related aggression has been found to be largely impulsive in nature (Heinz, Makin-Byrd, Blonigen, Reilly, & Timko, 2015; Miles, Menefee, Wanner, Teten Tharp, & Kent, 2015; Teten et al., 2010) and associated with symptoms of hyperarousal (Kachadourian et al., 2013; Pavic et al., 2003). In the context of driving, then, veterans with PTSD may be more likely to perceive threat and to attribute hostile intent to other drivers, diminishing their motivation to inhibit impulsive aggressive responses for which they are already physiologically primed.

Study Limitations & Conclusion

The present study has several limitations that should be considered when interpreting these findings. The primary limitation is that the outcome variable of road rage was assessed with a single self-report item: “In the past year, have you felt you wanted or needed to cut down on aggressive driving or ‘road rage?’” While the definition of aggressive driving or road rage may be somewhat intuitive, a more clearly operationalized definition of the construct would help improve confidence that what is being measured is a specific set of behaviors, rather than a mixture of behavior and insight. Kuhn et al (2010), for example, specified angry hand gestures, tailgating, cutting off other drivers, chasing other drivers, or intentionally driving into another object as aggressive driving. As the research in this area evolves, more clearly operationalized definitions of aggressive driving and road rage will become increasingly necessary.

Self-report checklists were also used to evaluate for the presence of PTSD and TBI. The limitation of our checklist for TBI may have particularly important implications for the interpretation of our findings because the items did not allow us to make any determination about severity or frequency head injuries. We also did not assess length of time since the most recent head injury, a potentially important data point given that the majority of post-concussive symptoms remit in mild TBI after about three months at least for non-repetitive head injuries (Karr, Areshenkoff, & Garcia-Barrera, 2014). An additional limitation concerns the cross-sectional design of the study, which does not allow us to determine whether problems with aggressive driving existed prior to deployment or the onset of PTSD and/or TBI. Keeping these limitations in mind, the present findings suggest that PTSD increases returning veterans’ risk of aggressive driving, regardless of TBI status. These data add to the growing literature indicating that PTSD may be a critical factor in the increased risk for MVA-related injury and death faced by combat veterans when they return home from service in a war zone.

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Impact

- The findings of this study suggest that PTSD increases returning veterans' risk of aggressive driving, regardless of TBI status. These data add to the growing literature indicating that PTSD may be a critical factor in the increased risk for MVA-related injury and death faced by combat veterans when they return home from service in a war zone.
- From a clinical standpoint, this suggests that treatment of PTSD in combat veterans could benefit from assessment of aggressive driving, and the inclusion of aggressive driving as an outcome in treatment plans.
- Our findings may also suggest that post-deployment education aimed at helping military personnel transition from combat-style aggressive driving behaviors to the more defensive approach appropriate to civilian settings may be warranted.

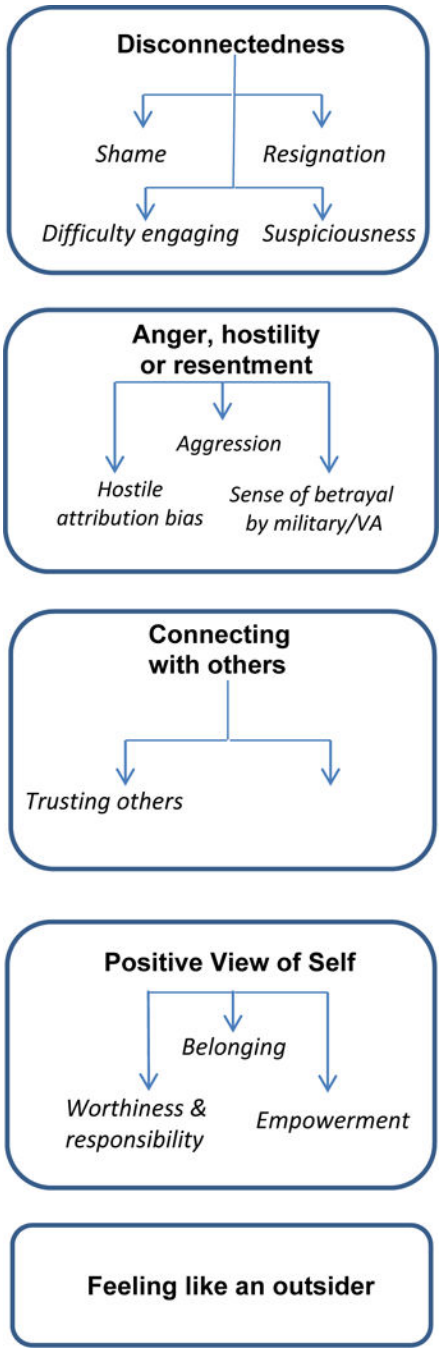

Figure.
Themes and Subthemes

Table 1

Demographic and Clinical Characteristics

Variable	Mean (SD) or *n* (%)
Age (*n*=1099) [a]	38.8 (9.8)
Male	907 (82.5%)
Race	
African-American	184 (16.7%)
White	783 (71.3%)
Other race	132 (12.0%)
Married (*n*=1090)[a]	774 (71.0%)
Employment status (*n*=1101) [a]	
Active duty military or full time civilian	725 (65.9%)
Part time civilian or student	90 (8.2%)
Other	286 (26.0%)
Military component (*n*=1071) [a]	
Active duty	668 (62.4%)
Reserves/National Guard	403 (37.6%)
Enlisted (vs. Officer) (*n*=1090) [a]	808 (74.1%)
Used VA for health care since deployment (*n*=1062) [a]	388 (36.5%)
Income < $30,000 per year (*n*=1085) [a]	188 (17.3%)
# types combat trauma	4.01 (4.03)
PTSD/TBI status	
neither	877 (79.8%)
TBI, no PTSD	69 (6.3%)
PTSD, no TBI	96 (8.7%)
TBI and PTSD	57 (5.2%)
Problem with road rage	305 (27.8%)

[a]These variables had missing data and were imputed to create a full dataset for regression analyses. All other variables *N* = 1102.

Table 2

Logistic regression Predicting “Road Rage” as a Factor of TBI/PTSD Status

Variable	OR	95% CI
Intercept	0.44*	[0.22, 0.89]
Age	0.98*	[0.96, 0.99]
Minority status (white=1, non-white=0)	1.20	[0.85, 1.71]
Gender (male=1, female=0)	0.89	[0.60, 1.32]
Marital status (married=1, not married=2)	1.11	[0.80, 1.54]
Officer	0.57**	[0.39, 0.83]
Use of VA health care services (0=no use since last deployment, 1=use since last deployment)	1.24	[0.91, 1.68]
# types combat trauma	1.09***	[1.05, 1.13]
TBI, no PTSD	1.22	[0.70, 2.13]
PTSD, no TBI	3.44***	[2.14, 5.52]
TBI & PTSD	4.71***	[2.46, 9.00]

Note: index is “*no TBI*”

* $p < .05$

** $p < .01$

*** $p < .001$