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#### 14. ABSTRACT

This study examines the extent to which combat driving behaviors and anxieties are carried-over into driving on American roads post-deployment from service in Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn (OEF/OIF/OND) and compares such behaviors in Service Members (SMs) who have and have not served in hose combat operations and who do and do not have mild traumatic brain injury (mTBI) and/or PTSD. Four sites are now distributing the survey: Dwight D. Eisenhower Medical Center, FT Gordon; Fox Army Health Center at Redstone Arsenal; Medical Task Force Shelby (MTFS), Camp Shelby; and Blanchfield Army Community Hospital at Fort Campbell. The small sample of SM returns ((n=19) demonstrate that SMs with TBI report significantly more frequent problem driving behaviors than do those without TBI. There were no significant differences in driving related anxieties, weapons carried in POV, moving violations, or perceptions of driving behaviors as dangerous. Service members with PTSD had no significant differences in any scale scores, including problem driving behaviors. A larger sample will allow us to determine if TBI, more than PTSD, is the diagnosis associated with driving problems. Paired samples of SMs with TBI and/or PTSD and a Family/Friend informant (n=12 pairs) demonstrate that Family/Friends consistently underestimate the driving challenges faced by SMs in terms of driving behaviors, anxieties, POV weapons carried, and perceived dangerousness of selected driving behaviors. If results from larger samples follow these initial analyses clinical programs may be most needed by SMs with TBI, and special programs of information may be appropriate for Family/Friends.

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## **INTRODUCTION:**

Service Members (SMs), especially Soldiers, serving in Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) (and newly Operation New Dawn (OND)) use combat driving maneuvers to avoid roadway threats. These become automatic as they are performed repeatedly and strongly linked to safety. A regional pilot study by the PI and graduate students (Riley-Chiabotti, Hieb, Welle, **Stern**, 2008; **Stern**, 2009; Christensen, Escobar, Riess, **Stern**, 2009) indicated that post-deployed Soldiers may have high levels of carryover behaviors and anxieties and that these behaviors are long lived issues – lasting for several months post-deployment. Reflecting Killgore, Cotting, Thomas, et al's. (2008) finding that general combat trauma influences risky behaviors post-deployment (including risky driving), driving carryover behaviors and anxieties regressed significantly on the level of Soldiers' OIF/OEF driving-related trauma (Polzin, Wenker, **Stern EB**, 2009). The current CDMRP study builds on these findings, using a drop-off-mail-back survey to provide firm national data on the scale, incidence, and timeline of combat-driving behaviors among post-deployed Soldiers with and without mild traumatic brain injury (mTBI) or mTBI with post-traumatic stress syndrome (mTBI/PTSD), and compares Post-deployment Soldiers to Soldiers who have not served in OEF/OIF/OND. The study's goals are to determine the extent to which combat driving tendencies are carried over into post-deployment driving on American roads by Soldiers with mTBI and those without mTBI, to separate driving behaviors associated with military service from those associated with brain injury or deployment, to examine the impact of dual diagnosis of mTBI/PTSD on driving carryover, and to establish military respondents' self-recognition of driving behaviors relative to an informed third party report as a measure of self-awareness. The ultimate purpose of the study is to describe post-driving behaviors and to clarify the needs that will appropriate post-deployment program development for Soldiers, families, and communities.

## **BODY:**

The project continues to use a drop off- mail/phone return (no phone returns thus far). The project is receiving returned surveys from the original site (Dwight D. Eisenhower Medical Center, FT Gordon) and from three additional sites added this year (Fox Army Health Center at Redstone Arsenal; Medical Task Force Shelby (MTFS), Camp Shelby; and Blanchfield Army Community Hospital at Fort Campbell). A fifth site, USARIEM FT Detrick, is in the process of their multiple IRB review levels. When completed it is hoped that it will provide substantial numbers of Service Members (SMs).not yet deployed to OIF/OEF/OND.

A total of 19 Service Members' and 17 Family/Friends' surveys have been received, data entered, double-checked, cleaned, prepared for and subjected to analyses.

- TBI/post-concussion (TBI) only (n= 6 )
- PTSD only (n=2 )
- Dual (TBI/PTSD) n= 9
- Neither TBI nor PTSD n= 2

Thirteen surveys, were paired (i.e., one SM, one Family/Friend). Twelve were from SMs with TBI/PTSD or both,

An additional 13 SM and 10 Family/Friends surveys were received too late to be included in these preliminary analyses, but will be analyzed prior to the first quarter's report.

Comparisons were run between

- TBI/post-concussion (TBI) (n=15) vs non- TBI (n=4), and
- PTSD (n=11) vs non- PTSD (n=8).
- And SMs vs Family/Friend

All SMs had been deployed to Iraq/Afghanistan. Sample size did not allow assessment of those with only TBI or PTSD diagnoses vs. those with the two comorbidities. This is planned for a when a larger sample is available.

### **Traumatic Brain Injured (TBI/post-concussion) vs Non-TBI Group Equivalence (TBI vs. non- TBI)**

Demographic and combat experience items that were ordinal/nominal were assessed using non-parametric (Man-Whitney/Wilcoxon; chi square). Interval items were compared using independent t-tests. Service members with TBI showed no significant difference in common demographic measures: age, sex, marital status, race/ethnicity. Persons with TBI, reported less involvement in convoy duty during most recent deployment, but significantly more frequent times as a passenger or driver in land vehicle, more miles travelled in average week, and more times driving through small arms fire and near IED explosions in their most recent deployment. It is unknown if this is integrally associated with TBI (i.e., those with more such exposure and trauma have more TBI) or if it is a difference that will need to be controlled in analysis of larger sample.

#### **Homefront driving**

Items querying about the past 30 days driving on U.S. roads were formed into five scale scores. These were compared using independent t-tests. These scale scores were:

1. Violations (e.g., warnings, tickets for moving violations, vehicle crashes)

2. Driving behaviors (e.g., common post-deployment driving behaviors such as moving through stop signs or red lights, chasing cars, hypervigilance). These were derived from the literature, interviews with SMs and from data from the earlier regional study of driving.
3. Driving related anxieties of returned SMs ( e.g., anxiety related to driving at night, stopping in traffic)
4. Weapons carried in the responding SMs' privately owned vehicle (POV)(e.g., gun, knife, pepper spray)
5. Perceived driving danger of specified driving behaviors

Mean scale scores were used for violations, behaviors, anxieties, and perceived driving danger scales to control for the influence that missing data might have had on sum-based scores. The number of POV weapons was analyzed using the scale score sum because it was not at risk for this missing data influence.

### **Results:**

SMs with TBI had significantly higher mean driving behavior scale scores (indicating more frequent problematic behaviors) than did non-TBI service members: TBI Mean=1.91 (sd= .43) ; non-TBI Mean=2.74 (sd=.56) ( $t = -2.71$  ,  $p = .015$ ). MannWhitneyU/Wilcoxon signed rank analysis of individual driving behavior items showed significantly worse behavior for SMs with TBI in 5 out of the 24 items (21%), specifically for:

- Made turns/lane changes without signaling ( $p = .013$ )
- Drove through stop sign ( $p = .020$ )
- Drove much slower than other cars on road ( $p = .033$ )
- Been startled at common road sounds ( $p = .039$ )
- Asked someone else to drive in situations when the respondent would have normally driven ( $p = .038$ )

Paired t-tests showed no significant differences between the scale scores of TBI and non-TBI SMs' mean driving violations ( $p = .089$ ), driving related anxieties( $p = .425$ ), perceived driving dangers ( $p = .256$ ) and sum of weapons kept in POV (.167; where SMs with TBI reported a Mean=2.0 weapons, s.d.=1.414, and those with TBI reported a Mean=1.83 weapons, s.d.=1.03). Eight SMs (53%) with TBI reported carrying a gun in their POV, and the same number carried a knife in their vehicle.

Although driving related anxiety mean scale scores did not differ significantly between the two groups, TBI SMs reported significantly more frequent anxiety/anger/discomfort for 2 of the 14 anxiety scale score items (14%):

- Driving at high speeds even if within the speed limit ( $p = .049$ )
- Stopped at a red light ( $p = .020$ )

There was no significant difference between the two SM groups in terms of their global self-assessment of the degree of their carryover of driving habits from deployment ( $p = .446$ ), or in their estimate of how driving changed relative to deployment ( $p = .457$ ). However, SMs with TBI reported that they were significantly more anxious than non-TBI SMs when driving in general ( $p = .011$ ), and were also significantly more bothered by their anxiety/anger/discomfort ( $p = .019$ ).

### **Post Traumatic Stress Disorder (PTSD)**

**Group Equivalence (PTSD vs non-PTSD):** Demographic and combat experience items that were ordinal/nominal were assessed using non-parametric (Man-Whitney/Wilcoxon; chi square) and interval items were compared using independent t-tests. Service members with PTSD showed no significant difference in common demographic measures: age, sex, marital status, race/ethnicity, but SMs with PTSD did report significantly more times driving through small arms fire and exposure to artillery/RPG/mortar fire during their most recent deployment.

### **Homefront driving**

The mean scale scores were again used to compare SMs with PTSD and those without-PTSD for driving violations, behaviors, anxieties, and perceived danger scales. The sum score was used for POV weapons.

**Results:** Although SMs with PTSD had higher scores than non-PTSD SMs across all mean scale scores, these differences did not reach statistical significance for any measure. Both groups were similar in their driving violations ( $p = .119$ ), behaviors ( $p = .217$ ), anxieties ( $p = .256$ ) perceived dangers ( $p = .037$ ) and sum of POV weapons ( $p = .250$ ).

As noted, there was no significant difference in average numbers of weapons carried in POVs, with 55% of SMs with PTSD carrying at least one weapon, and all of those without PTSD (i.e., 100%) carrying at least one weapon. Four (36%) SMs with PTSD reported carrying a gun in their POV, and the same number carried a knife. These four SMs form a subset of the 8 listed in TBI, having dual diagnoses.

One marginally significant item was of interest. That item was "Chasing cars". This was marginally worse for SMs with PTSD than those without-PTSD ( $p = .064$ ); with 55% ( $n=6$ ) of those SMs with PTSD reporting this activity in the past 30 days, and only 12.5% ( $n=1$ ) SM without PTSD reporting this behavior. There was no significant difference between SMs with PTSD and those without on summary items about their level of being bothered by anxiety ( $p = .620$ ) or their general anxiety when driving ( $p = .896$ ).

## **Service Members vs. Family/Friends**

### **Demographics**

The SMs in this sample had all been deployed to OIR/OEF/or OND. Two SMs had only PTSD, 4 had only TBI, 6 had both PTSD and TBI and one had neither. For these preliminary analyses, we removed the one SM who reported no form of injury, and compared the SMs with TBI, PTSD or dual diagnosis against the Family/Friends' responses. Of the twelve subjects who responded to the question, 16.7% were engaged to the SM, 75% were a spouse or partner, and 8.3% were friends; 41.7% were in the service themselves, the majority being in the Army.

### **Homefront driving**

Items about the past 30 days driving on U.S. roads were formed into the same five scale scores used in TBI/nonTBI and PTSD/non-PTSD comparisons. These were compared using paired t-tests; individual items were examined using Wilcoxon Signed Rank for paired data. Mean scale scores were again used for violations, behaviors, anxieties, and perceived driving danger scales to control for the influence that missing data might have had on sum-based scores. The number of POV weapons was analyzed using the scale score sum because it was not at risk for influence from missing data.

**Results:** Violations was the only mean scale score that did not differ significantly between the SMs and Family/Friends ( $p=1.000$ )

SMs reported significantly more frequent problem driving behaviors (SM Mean= 2.52  $sd=.355$ ; FF Mean=1.85,  $sd=.437$ ,  $t=3.32$ ,  $p=.008$ ), and mean driving related anxieties (SM Mean= 2.65,  $sd=.324$ ; FF Mean=2.04,  $sd=.809$ ;  $t=2.85$ ,  $p=.016$ ). SMs also reported carrying significantly more weapons in POV than estimated by their Friends/Family (SM average Sum=1.83,  $sd=.753$ ; FF average sum=1.00,  $sd = .00$ ;  $t=2.71$ ,  $p=.042$ ). SMs also had significantly worse mean estimates of the dangerousness of driving behaviors (SM Mean=2.04,  $sd=.382$ ; FF Mean= 1.54,  $sd=.321$ ;  $t=4.30$ ;  $p=.002$ ), a measure where higher scores indicate behaviors judged being less dangerous.

SMs were also significantly more anxious when driving than estimated by the Family/Friend: with Friends and Family estimated median value being 'A little Anxious', and SMs median at the next level "Somewhat Anxious".

## **KEY RESEARCH ACCOMPLISHMENTS**

- Three additional sites were approved to distribute survey with one more in IRB (for USARIEM) continuing its multi-stage review process
- Larger numbers of survey packets being returned, especially from new sites.
- Exploratory analysis of returned surveys initiated

## **REPORTABLE OUTCOMES:**

- Submission to present project at World Federation of Occupational Therapy (Japan, 2014). Decision expected September 30, 2013.

## **CONCLUSION:**

These analyses are interim and exploratory. The small sample size (SM  $n=19$ ; paired SM/FF=12), large number of subjects with comorbidities of TBI and PTSD, and difference in sample size between SMs with TBI and those without-TBI allows for only tentative interpretation of these results.

**Finding 1:** It is unclear whether SMs with TBI are more likely to have had combat related driving trauma, or if combat related driving trauma is more likely to cause, and therefore be associated with TBI and to a weaker extent PTSD. **It is possible that selected combat experiences will need to be controlled in the final, larger sample.** A larger sample should also make it possible to control for comorbidity and to determine the impact of TBI and PTSD separately and as comorbidities. Although not part of the original questions, this issue is key to targeting potential clinical recommendations.

**Finding 2:** Within this small sample, SMs with TBI reported significantly more problematic driving behavior than those without. Indeed, SMs with TBI had an average of nearly a full category more frequent problem driving behaviors (i.e., 20% of possible range) than those without TBI. When compared to other published and non-published studies, the five items that were different between the two groups included both typical problems behaviors (i.e., running stop signs, startling at road sounds, asking another to drive in their stead), and atypical behaviors (i.e., driving excessively slowly).

It is surprising that the SMs with and without PTSD were statistically similar for all five scale scores, especially for driving related anxiety mean scale score. The marginally significant greater score of SMs with PTSD for the single item 'chasing cars' modestly supports literature findings that strongly relates this behavior to SMs with PTSD (Kuhn, Drescher, Ruzek, and Rosen, 2010).

SMs with TBI and those with PTSD carried about the same numbers of weapons in their POVs. One study reported 52% of presumably uninjured SMs carrying weapons post-deployment (Stern, et al., 2010). In the current study, the high numbers of weapons in POVs of SMs with TBI and PTSD, and the high percentage of SMs with TBI carrying guns in their vehicles may reasonable cause for concern when one considers the diagnoses' association with impulsivity, slow processing, and impaired decision making.

**Finding 3:** The large percentage of SMs with comorbidity (TBI and PTSD) (47%), limits our ability to determine the relative effects of TBI vs PTSD, but it is interesting to note that comparison of PTSD/non-PTSD showed no significant difference in any of the scale scores, whereas comparison of TBI and non-TBI groups showed significant difference between the groups in both the behavioral scale score and in two summary item scores. . .

Other research has associated several driving problems and driving related anxieties with PTSD (Kuhn, Drescher, Ruzek, and Rosen, 2010; Lew et al, 2011; Sayer et al., 2010); . However, those studies did not compare TBI to PTSD nor did they differentiate between persons with only PTSD vs. those with the dual diagnosis of TBI and PTSD. The current data tentatively indicates that TBI may be the diagnosis that differentiates driving behaviors.

**Finding 4:** Comparisons of the paired SM and Family/Friend (n=12 pairs with diagnosis/diagnoses) consistently showed Family/Friends know that there are problems, but significantly underestimate the driving problems faced by their SM. Hieb's study (2008) of a normal returning company of SMs found similar underestimate by Family/Friend. Hieb suggested several possible explanations for this finding, positing that it might reflect:

- *Family/Friends* being unaware of even consistent driving behaviors and anxieties – afterall, Friends/Family get only a sample of SMs driving, and may not be told about behavior, or anxieties, whereas violations may be more commonly discussed.
- *Family/Friends* minimizing SMs dangerous driving behaviors and anxieties out of denial, because the Friends/Family are overwhelmed, and need to bolster a sense that the SMs are safe drivers (e.g., able to take on responsibilities within the household).

The current data are too small to lead a clinical change, but if these findings persist with a larger sample, they may support the need for programing to inform Family/Friends of the potential driving issues and to mindfully assist open communication between SMs and Family/Friends about driving issues, to improve SMs' likelihood of safe reintegration into driving.

**ADMINISTRATIVE COMMENTS (OPTIONAL)** – Works performed this year that were assisted by the PI's work on this grant, and related to military challenges re. driving include:

- **Interviews show continued public interest in driving reintegration issues:**
  - Washington Post (interviewed by David Brown) (May 05, 2013). **Motor vehicle crashes: A little-known risk to returning veterans of Iraq and Afghanistan.** [http://articles.washingtonpost.com/2013-05-05/national/39048053\\_1\\_motor-vehicle-crashes-two-wars](http://articles.washingtonpost.com/2013-05-05/national/39048053_1_motor-vehicle-crashes-two-wars)
  - Austin Investigative Team (interviewed by Brenda Bell) (September 30, 2012). **Uncounted Casualties: Accidents - After returning home, many veterans get into motor vehicle accidents.** Austin American Statesman , <http://www.statesman.com/news/news/local-military/veterans-motor-vehicle-accidents/nSPH8/>

- **Papers:**

- Zinzow, HM, Brooks, J, **Stern, EB** (2013). Driving-related anxiety in recently deployed service members: Cues, mental health correlates, and help-seeking behavior. *Military Medicine*. 178, (3), pp. e357-e361(5)
- Radomski, MV, Weightman MM, Davidson LF, Finkelstein M, Goldman S, McCulloch K, Roy TC., Scherer M, , Finkelstein M, **Stern EB** (2013). Development of a measure to inform return-to-duty decision making after mild traumatic brain injury, *Military Medicine*, 178, 246-253.
- **Guidelines/Recommendations:**
  - Member of DCoE Traumatic Brain Injury Clinical Standards of Care -working group on clinical recommendations for “Graded Activity Following mild-TBI” – Recommendations in second review.
  - *Driving Screening, Treatment, and Referral for Generalist Occupational Therapists: Clinical Recommendations for Clients Following Traumatic Brain Injury*, by All Branches Occupational Therapy Consortium (ABOTC).
    - Extensive changes requested. Document is in re-review by ABOTC driving work group.
    - Pilot form of document has been heavily distributed in civilian and military treatment facilities, and is in common use as an interim document.
- **Presentations:**
  - **Stern, EB** (2012) *Shifting Gears: Driving reintegration following deployment, concussion, and PTSD*. Distinguished Visiting Professor at the Southern Regional Medical Command (SRMC) TBI Grand Rounds, San Antonio Military Medical Center, San Antonio, TX. Invited presentation.

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**APPENDICES: None**

**SUPPORTING MATERIALS: None**