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**PT073853:** *Mild TBI Following Exposure to Explosive Devices: Device Characteristics, Neuropsychological Functioning, and Symptoms of Post-Traumatic Stress Disorder*

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# REPORT DOCUMENTATION PAGE

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<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b> The purpose of the study was to examine the impact of PTSD, depression, and mild TBI on cognitive effort during neuropsychological testing, and to address whether standard cutoff scores should apply for interpretation on the TOMM. Frequency tables showed 90.3% of veterans obtained a score greater than the recommended cutoff on the second trial, including 84% with a perfect score of 50. Three subjects' results were highly suggestive of poor effort on both the TOMM and a recognition memory task. Results were as follows: sufficient effort ( $n = 28$ ) Trial 1 mean = 46.89 ( $SD = 3.17$ ), Trial 2 mean = 49.79 ( $SD = 0.96$ ); insufficient effort ( $n = 3$ ) Trial 1 mean = 28.67 ( $SD = 4.51$ ), Trial 2 mean = 34.67 ( $SD = 6.35$ ). Among veterans exhibiting sufficient effort, there were no significant correlations between effort scores and measures of age, education, PTSD, depression, irritability, and aggression. The recommended cut score on the TOMM is appropriate for interpreting insufficient effort in veterans with a combination of PTSD, depression, and a history of mTBI. Among outpatient veterans, the severity of depression and PTSD symptoms were not related to performance on the second trial of the TOMM.					
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## INTRODUCTION

OEF/OIF veterans are referred for neuropsychological evaluation as part of a multi-disciplinary evaluation for symptoms of traumatic brain injury. The first step in this neuropsychological evaluation is to ensure the validity of the results of the test scores by determining whether the examinee put forth adequate effort. Symptoms of PTSD, depression, and cognitive dysfunction from mild traumatic brain injury (mTBI) could possibly decrease motivation to perform well during neuropsychological testing. Forced choice memory tests, such as the TOMM, may be used to identify insufficient effort that invalidates test results. Normally, scores falling below a specified level are interpreted as suggesting insufficient effort. The validity of this assumption has not been reported in combat veterans with a combination of possible reasons for reduced motivation. The purpose of the current study was to examine the impact of PTSD, depression, and mTBI on effort, and to address whether standard cutoff scores should apply for interpretation.

## BODY

### **Tasks associated with objectives as listed in the grant proposal Statement of Work document**

1. Obtaining IRB approval for study: since data are preexisting and de-identified in nature, this should greatly expedite this process.

Approval for exempt status was obtained by both the IRB and the Research Committee at the Durham VA.

2. Training a research assistant: teaching how to find variables located in test protocols and entering information into a de-identified database.

Difficulty was encountered trying to find a full-time VA employee with the necessary skills, due to the time-limited nature of the study lasting 18 months. Therefore, hired two part-time VA employees as Research Assistants to complete data entry. Data were from an extensive, 5-hour battery of neuropsychological tests and other data. Trained regarding confidentiality and other ethical issues.

3. Data entry from neuropsychological test results.

Data entry is well under way. Out of 200 protocols, about 180 have been processed.

4. Verification of accuracy of data entry.

Verification will begin when data entry is completed.

5. Obtaining further training and knowledge at scientific meetings.

Will attend the Military Health Research Forum 2009, August 31, 2009 – September 3, 2009.

6. Statistical analyses.

Initial analyses performed.

7. Preparation of manuscripts.

Abstract accepted to present at the Military Health Research Forum. Please see description of research findings at the end of this list. In the process of developing a manuscript from this study. Will soon begin other manuscripts as well.

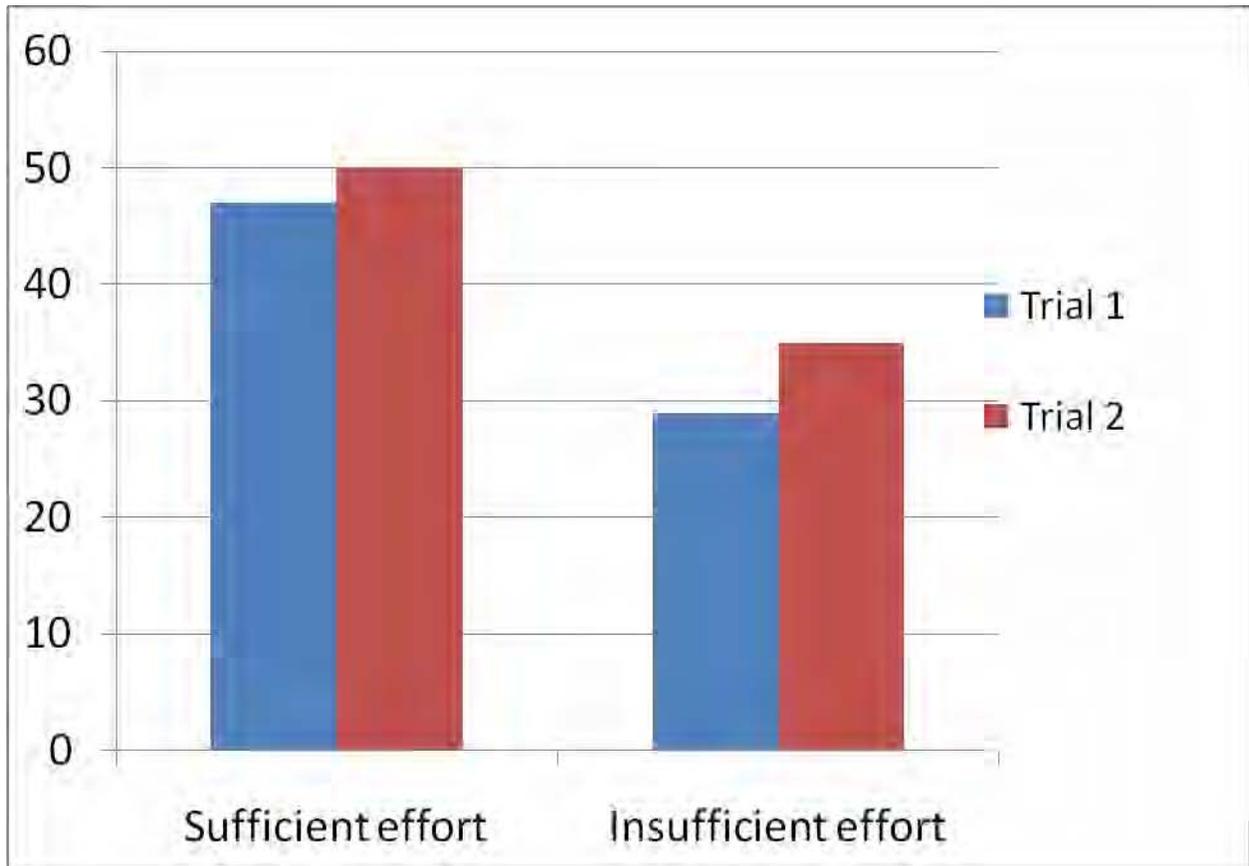
8. Submission and revision of manuscripts leading to publication.  
Not completed as of yet.

### **Data presentation:**

Thirty-one OEF/OIF veterans underwent neuropsychological assessment as part of a multidisciplinary evaluation to determine whether the veteran sustained mild traumatic brain injury. The test results are used for cognitive rehabilitation and to support disability compensation claims. All veterans reported exposure to at least one incident involving blast and/or mild blunt head trauma with or without brief loss of consciousness. Measures yielded scores related to symptoms of PTSD, depression, irritability, and effort.

The results of frequency tables showed 90.3% of veterans obtained a score greater than the recommended cutoff on the second trial, including 84% with a perfect score of 50 (Tucker, Tupler, Browndyke, & Capehart, 2009). Three subjects' results were highly suggestive of poor motivation on both the TOMM and a recognition memory task. Results are as demonstrated in figure 1: sufficient effort ( $n = 28$ ) Trial 1 mean = 46.89 ( $SD = 3.17$ ), Trial 2 mean = 49.79 ( $SD = 0.96$ ); insufficient effort ( $n = 3$ ) Trial 1 mean = 28.67 ( $SD = 4.51$ ), Trial 2 mean = 34.67 ( $SD = 6.35$ ). Subjects with sufficient effort obtained scores well within the recommended cutoff used to indicate a demarcation between adequate and inadequate effort. In fact, the standard cutscore was more than 3 SD below the mean of the sufficient effort group.

Among veterans exhibiting sufficient effort, there were no significant correlations between effort scores and measures of PTSD ( $r = -.25$ ,  $N = 28$ ,  $p = .26$ , two-tailed) or depression ( $r = -.17$ ,  $N = 28$ ,  $p = .44$ , two-tailed). Veterans with poor effort scores had greater service connection than those with sufficient effort (50% vs. 35%), and reported much greater symptom severity for PTSD and depression. Group differences in effort on Trial 2 were not significant (Mann-Whitney  $U$ ,  $z = -.96$ ,  $p = .34$ ) between the current veterans with a combination of PTSD/depression/cognitive deficits and a published group of data provided by Tombaugh with moderate to severe TBI (Tombaugh 1996). A literature review revealed no prior studies examining the impact of symptoms of PTSD, depression, and mild traumatic brain injury on effort scores. The current results demonstrate that among outpatient veterans, the severity of depression and PTSD symptoms were not related to performance on the second trial of the TOMM, therefore the standard cutscore should be used for interpretation of level of effort.



**Fig. 1: TOMM raw scores on trials 1 and 2 in the two groups, sufficient effort (n = 28) and insufficient effort (n = 3). A cut score of 45 is typically used to indicate adequate effort.**

### KEY RESEARCH ACCOMPLISHMENTS

- Trained two assistants
- Data entry of more than  $\frac{3}{4}$  of a large database (200 veterans) containing a 5-hour long neuropsychological battery, diagnostic information, and other data (e.g., pain severity, blast characteristics)
- Provided oral and poster presentations of the initial findings at the Military Health Research Forum 2009, August 31, 2009 –September 3, 2009

### REPORTABLE OUTCOMES

Oral and poster presentations of abstract below:

Tucker, K.A. Tupper, L.A., Browndyke, J.N., & Capehart, B.P. (2009, September). *Impact of PTSD, depression, and mild TBI on cognitive effort*. Proceedings from the Military Health Research Forum 2009, Kansas City, MO.

### CONCLUSION

The results of clinical neuropsychological evaluations are used to aid in understanding the severity of cognitive changes following mild traumatic brain injury. The interpretation of the test results may be complicated by the presence of symptoms of PTSD, depression, and especially poor effort. Poor

scores on effort tests would be indicative of invalid neuropsychological test scores in general. The current study sought to clarify whether veterans may have poor effort scores on the TOMM due to significant symptoms of PTSD, depression, and mild traumatic brain injury, rather than simply inadequate motivation. The results demonstrated that the recommended cut score on the TOMM is appropriate for interpreting insufficient effort in veterans with a combination of PTSD, depression, and a history of mTBI. Thus, there is no need to lower the standard recommended cutscore on the TOMM to accurately distinguish veterans with adequate effort from those with inadequate effort. The results may be used in clinical decision-making to aid in diagnosis/treatment.

Among outpatient veterans, the severity of depression and PTSD symptoms were not related to performance on the second trial of the TOMM. Ten percent of subjects in this sample demonstrated insufficient effort, which is low in comparison to estimates of 30% in civil litigation plaintiffs. Additional study with a larger patient sample is needed to confirm these findings.

**REFERENCES**

Tombaugh TN. TOMM: test of memory malingering. North Tonawanda, NY: Multi-Health Systems, Inc., 1996.

Tucker, K.A. Tupler, L.A., Browndyke, J.N., & Capehart, B.P. (2009, September). *Impact of PTSD, depression, and mild TBI on cognitive effort*. Proceedings from the Military Health Research Forum 2009, Kansas City, MO.

**APPENDIX**

Copy on next page of the poster presentation from the Military Health Research Forum 2009, Kansas City, MO.

Tucker, K.A. Tupler, L.A., Browndyke, J.N., & Capehart, B.P. (2009, September). *Impact of PTSD, depression, and mild TBI on cognitive effort*. Oral and poster presentations at the Military Health Research Forum 2009, Kansas City, MO.



## Impact of PTSD, depression, and mild TBI on cognitive effort

Karen A. Tucker, Larry A. Tupler, Jeffrey N. Browndyke, and Bruce P. Capehart  
VA Medical Center, Durham, NC and Duke University Medical Center

### Introduction

**Background:** Symptoms of PTSD, depression, and cognitive dysfunction from mild traumatic brain injury (mTBI) could possibly decrease motivation to perform well during neuropsychological testing. Forced choice memory tests, such as the TOMM, may be used to identify insufficient effort that invalidates test results. Normally, scores falling below a specified level are interpreted as suggesting insufficient effort. The validity of this assumption has not been reported in combat veterans with a combination of possible reasons for reduced motivation. The current study examined the impact of PTSD, depression, and mTBI on effort, and addressed whether standard cutoff scores should apply for interpretation.

### Methods

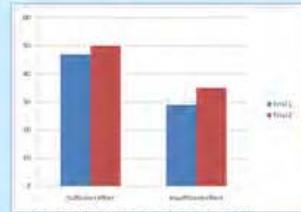
Thirty-one OEF/OIF veterans underwent neuropsychological assessment as part of a multidisciplinary evaluation to determine whether the veteran sustained mTBI. The test results

are used for cognitive rehabilitation and to support disability compensation claims. All veterans reported exposure to at least one incident involving blast and/or mild blunt head trauma with or without brief loss of consciousness. Measures yielded scores related to symptoms of PTSD, depression, irritability, and effort.

### Results

Frequency tables showed 90.3% of veterans obtained a score greater than the recommended cutoff on the second trial, including 84% with a perfect score of 50. Three subjects' results were highly suggestive of poor motivation on both the TOMM and a recognition memory task. Results were as follows: sufficient effort ( $n = 28$ ) Trial 1 mean = 46.89 ( $SD = 3.17$ ), Trial 2 mean = 49.79 ( $SD = 0.96$ ); insufficient effort ( $n = 3$ ) Trial 1 mean = 28.67 ( $SD = 4.51$ ), Trial 2 mean = 34.67 ( $SD = 6.35$ ). Subjects with sufficient effort obtained scores well within the recommended cutoff that was more than 3 SD below the mean of the sufficient

effort group. Among veterans exhibiting sufficient effort, there were no significant correlations between effort scores and measures of age, education, PTSD, depression, irritability, and aggression, perhaps due in part to the restricted range of the 50-item measure. Veterans with poor effort scores had greater service



connection than those with sufficient effort (50% vs. 35%), and reported much greater symptom severity for PTSD, irritability, and depression. Group differences in effort on Trial 2 were not significant between veterans with a combination of PTSD/depression/cognitive deficits and a group with moderate to severe TBI (Mean = 49.4,  $SD = 1.3$ , normative data by Tombaugh 1996).

### Conclusions

The recommended cut score on the TOMM is appropriate for interpreting insufficient effort in veterans with a combination of PTSD, depression, and a history of mTBI. Among outpatient veterans, the severity of depression and PTSD symptoms were not related to performance on the second trial of the TOMM. Ten percent of subjects in this sample demonstrated insufficient effort, which is low in comparison to estimates of 30% in civil litigation plaintiffs. Additional study with a larger patient sample is needed to confirm these findings.

This work was supported by the U.S. Army Medical Research and Materiel Command under W81XWH-08-2-0050.