



United States Government Accountability Office
Washington, DC 20548

October 24, 2011

Congressional Requesters

Subject: *Department of Defense: Use of Neurocognitive Assessment Tools in Post-Deployment Identification of Mild Traumatic Brain Injury*

Traumatic brain injury (TBI) has emerged as a serious concern among U.S. forces serving in military operations in Afghanistan and Iraq. The widespread use of improvised explosive devices in these conflicts increases the likelihood that servicemembers will sustain a TBI, which the Department of Defense (DOD) defines as a traumatically induced structural injury and/or physiological disruption of brain function as a result of an external force.¹ TBI cases within DOD are generally classified as mild, moderate, severe, or penetrating. From 2000 to March 2011 there were a total of 212,742 TBI cases reported by the Defense and Veterans Brain Injury Center within DOD. A majority of these cases, 163,181, were classified as mild traumatic brain injuries (mTBI)—commonly referred to as concussions.²

Early detection of injury is critical in TBI patient management. Diagnosis of moderate and severe TBI usually occurs in a timely manner due to the obvious and visible nature of the head injury. Identification of mTBI presents a challenge due to its less obvious nature. With mTBI, there may be no observable head injury. In addition, in the combat theater, an mTBI may not be identified if it occurs at the same time as other combat injuries that are more visible or life-threatening, such as orthopedic injuries or open wounds. Furthermore, some of the symptoms of mTBI—such as irritability and insomnia—are similar to those associated with other conditions, such as post-traumatic stress disorder.

Although the majority of patients with mTBI recover quickly with minimal intervention, a subset of patients develops lingering symptoms that interfere with social and occupational functioning. Accurate and timely identification of mTBI is important as treatment can mitigate the physical, emotional, and cognitive effects of the injury. Neurocognitive deficits associated with mTBI can be identified by neurocognitive assessment tools. These tools generally consist of a series of tests that measure

¹Department of Veterans Affairs/DOD, *Clinical Practice Guideline for Management of Concussion/mild Traumatic Brain Injury* (April 2009).

²DOD specifies that a person may be designated as having an mTBI only if the severity of the injury does not include: (1) loss of consciousness that lasted longer than 30 minutes; (2) alteration of consciousness for more than 24 hours; (3) post-traumatic amnesia lasting longer than 24 hours; or (4) an initial score of less than 13 on the Glasgow Coma Score, a widely-used 15-point scoring system for assessing coma and impaired consciousness. (Higher scores indicate a less severe injury while lower scores indicate a more severe injury.)

cognitive performance areas that may be impaired by an mTBI such as attention, judgment, and memory.

Identification of mTBI in servicemembers who served in Afghanistan and Iraq has been the subject of recent media attention, with particular attention focused on the proper use of neurocognitive assessment tools to screen all servicemembers post-deployment for deficits or symptoms related to mTBI. In this context and in response to your request, this report describes (1) DOD's post-deployment policy on the use of neurocognitive assessment tools as a stand-alone initial screen to identify servicemembers who may have sustained an mTBI during deployment; (2) what informed DOD's decisions to establish this post-deployment policy; and (3) mTBI experts' views on the science related to DOD's policy decision.³ Additionally, you have expressed the importance of recording mTBI in a servicemember's medical history to ensure proper treatment. In response to this concern, we are initiating a review of DOD's in-theater documentation of servicemembers involved in potentially concussive events.

To describe DOD's post-deployment policy on the use of neurocognitive assessment tools as a stand-alone initial screen to identify servicemembers who may have sustained an mTBI during deployment, and what informed DOD's decisions to establish this post-deployment policy, we reviewed relevant DOD policy and guidance and interviewed DOD officials involved in DOD TBI policy. We also reviewed documents that DOD cited as support for its decision, such as task force and expert panel reports, and scientific studies. To describe mTBI experts' views on the science related to the policy decision, we interviewed 15 mTBI experts within and outside of DOD in the fields of military concussion and sports concussion. We selected experts through a snowball sampling method and through structured searches of the military and sports concussion literature.⁴ We interviewed sports concussion experts because the sports population has experience in the use of neurocognitive assessment tools to help identify mTBI. The views of the experts we interviewed cannot be assumed to be the views of all mTBI experts.

We conducted this performance audit from April 2011 through October 2011 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Results in Brief

DOD does not require that all servicemembers be screened post-deployment using a neurocognitive assessment tool but does require that all servicemembers be screened using a set of TBI screening questions. According to DOD officials, this policy was informed by findings and recommendations from several task forces and

³For the purposes of this report, we define post-deployment as within 30 days after servicemembers' return from deployment.

⁴A snowball sample includes an initial list of cases, each of whom is asked for referrals to additional people, who are then interviewed and asked for referrals, and so on. We repeated this process until we were consistently receiving substantively similar information from each additional interview.

expert panel reports, and scientific studies. Additionally, mTBI experts told us that the scientific evidence supports DOD's policy. For example, these experts told us that neurocognitive assessment tools cannot determine whether low cognitive function is caused by an mTBI. These experts told us, however, that neurocognitive assessment tools can be useful as part of a full clinical evaluation for a person who has already screened positive for a possible mTBI.

DOD Policy Does Not Require Screening All Servicemembers with a Neurocognitive Assessment Tool Post-Deployment

DOD policy does not require that all servicemembers receive an assessment with a neurocognitive assessment tool as a stand-alone initial screen for mTBI post-deployment. Instead, DOD requires initial screening of all servicemembers using TBI screening questions as part of the post-deployment health assessment (PDHA) process. The PDHA process is designed to self-identify and refer for further evaluation servicemembers with health concerns as a result of deployment.⁵ During the PDHA process, a servicemember completes a form that includes TBI screening questions.⁶ A health care provider reviews the completed form and may refer the servicemember to a clinician for further evaluation for a possible mTBI.⁷ As part of that evaluation, a DOD official told us that clinicians may choose, but are not required, to use a neurocognitive assessment tool to help identify symptoms consistent with an mTBI. DOD anticipates issuing in the first quarter of calendar year 2012 additional policy on post-deployment neurocognitive assessment tools, according to a DOD official. The DOD policy will specify the use of a particular tool that clinicians should use if they choose to use a neurocognitive assessment tool during the clinical evaluation of a servicemember referred post-deployment through the PDHA process.

A May 28, 2008, DOD interim guidance requires that neurocognitive assessments using the Automated Neuropsychological Assessment Metrics (ANAM) neurocognitive assessment tool be administered to all servicemembers prior to deployment. According to a DOD official, the upcoming policy on post-deployment neurocognitive assessment will also specify use of the ANAM, if clinicians choose to use a neurocognitive assessment tool. DOD is currently conducting a head-to-head study of five neurocognitive assessment tools (including the ANAM) in order to identify the tool best suited to military use. After significant delay, DOD anticipates

⁵DOD policy requires that the PDHA be completed by servicemembers within 30 days before or 30 days after return from deployment.

⁶The TBI screening questions on the PDHA are designed to be completed by the servicemember in four series. The sequence of questions specifically assesses (1) events that may have increased the risk of a TBI, (2) immediate symptoms following the event, (3) new or worsening symptoms following the event, and (4) current symptoms. If there is a positive response to any question in the first series, the servicemember completes the second and third series; if there is a positive response to any question in the third series, the servicemember completes the fourth series about current symptoms. The form directs the health care provider to refer the servicemember based on the servicemember's current symptoms.

⁷According to the Department of Veterans Affairs/DOD *Clinical Practice Guideline for Management of Concussion/mild Traumatic Brain Injury*, a clinical evaluation for mTBI should include (1) obtaining a detailed medical history (including details of the injury event and identification of symptoms); (2) a psychosocial assessment (including assessment of conditions that may exacerbate mTBI symptoms, such as post-traumatic stress disorder); and (3) a physical exam.

results of that study in 2015. DOD officials told us that DOD will then specify that the selected tool be used consistent with DOD policy on neurocognitive assessment.

Reports and Scientific Studies Informed DOD's Policy

According to a DOD official with responsibility for DOD's policy on mTBI, the use of neurocognitive assessment tools post-deployment was informed by findings and recommendations from several task forces and expert panel reports, and scientific studies. The DOD official told us that DOD determined that these sources did not provide evidence to support the use of neurocognitive assessment tools as a stand-alone initial screen for mTBI for all servicemembers post-deployment. The DOD official cited several reports as supporting their policy of not requiring that all servicemembers be assessed with a neurocognitive assessment tool post-deployment because these reports are silent on the use of such tools post-deployment.⁸ Additionally, the DOD official told us that one report and two scientific studies provided further support for not using a neurocognitive assessment tool as a stand-alone initial screen for mTBI for all servicemembers when they return from deployment.

The following describes the recommendation and suggestions of the report and studies and the DOD official's explanation of how they provided support for DOD's policy.

- The 2007 Army TBI Task Force report to the Surgeon General⁹ recommended that DOD implement a post-deployment neuropsychological evaluation using the ANAM. However, the report reiterated several limitations of using a neurocognitive assessment tool as a stand-alone initial screen for mTBI, including limitations that could affect the accuracy of the tool. The DOD official told us that the report's recommendation in conjunction with the limitations regarding the use of neurocognitive assessment tools stated in the report supports their policy of using the PDHA, rather than the ANAM.
- A study conducted at Fort Bragg and published in 2009¹⁰ found no association between poor ANAM performance after deployment and self-reported history of mTBI. The DOD official told us that this study provides evidence that screening all servicemembers post-deployment with a neurocognitive assessment tool is not likely to be useful.

⁸August 2006 report of the Armed Forces Epidemiology Board; April 2007 *Independent Review Group on Rehabilitative Care and Administrative Processes at Walter Reed Army Medical Center and National Naval Medical Center*; June 2007 report of the Defense Health Board Task Force on Mental Health; October 2007 report of the Scientific Advisory Panel on the Use of the ANAM; and *Gulf War and Health: Volume 7: Long-Term Consequences of Traumatic Brain Injury*, Committee on Gulf War and Health: Brain Injury in Veterans and Long-Term Health Outcomes (Institute of Medicine, 2008).

⁹Traumatic Brain Injury Task Force, Report to the Surgeon General (May 2007).

¹⁰Brian J. Ivins, Robert Kane, Karen A. Schwab, "Performance on the Automated Neuropsychological Assessment Metrics in a Nonclinical Sample of Soldiers Screened for Mild TBI After Returning From Iraq and Afghanistan: A Descriptive Analysis," *Journal of Head Trauma Rehabilitation*, vol. 24, no. 1 (2009), 24-31.

- DOD has stated that findings from a study conducted at Ft. Campbell¹¹ support a selective use of the ANAM post-deployment but not as a stand-alone initial screen for mTBI for all servicemembers. The study found that at post-deployment, servicemembers reporting a history of mTBI, but not current mTBI symptoms, did not show a decline in cognitive functioning as measured by the ANAM. The DOD official told us that using the ANAM as a stand-alone initial screen for mTBI can result in false negative results for these servicemembers because the assessment tool was not able to identify that an mTBI had occurred for servicemembers without symptoms at post-deployment.¹²

MTBI Experts Told Us the Science Supports DOD's Policy

Experts in mTBI told us that the science related to neurocognitive assessment tools supports DOD's post-deployment policy with respect to screening for mTBI. These experts told us they do not believe that screening all servicemembers post-deployment with a neurocognitive assessment tool is beneficial to determine who may have sustained an mTBI during deployment. However, most of the experts told us they do believe that such tools can be useful to help a clinician determine whether a servicemember has sustained an mTBI in situations where a servicemember has already screened positive on the PDHA and was subsequently referred to a clinician for a full evaluation.

Experts gave several reasons why they support DOD's policy with respect to mTBI screening. For one, experts told us that neurocognitive assessment tools can indicate low cognitive function but cannot determine whether or not it is caused by an mTBI. They told us it is likely that confounding variables,¹³ such as lack of sleep, stress, and influence of medication—not mTBI—can be the cause of change in cognition in servicemembers at post-deployment. They said that these confounding variables could result in a large number of false positives¹⁴ when all servicemembers are assessed. Another reason is that such tools are designed to measure cognitive function and generally do not measure the physical aspects of mTBI, such as headaches, impaired balance, and sensitivity to light or noise. This oversight may potentially result in false negatives. Most experts told us that in order to reduce the number of false positives or negatives from assessments at post-deployment with a neurocognitive assessment tool, such tools should only be used during a full clinical evaluation for someone who already screened positive for the possibility of an mTBI on the PDHA. During that evaluation, the clinician can evaluate a servicemember's

¹¹Tresa Roebuck-Spenser, Andrea S. Vincent, David A. Twille, Bret W. Logan, Mary Lopez, Stephen Grate, Robert E. Schlegel, Kirby Gilliland, *Cognitive Change Associated with Deployment-Related Mild Traumatic Brain Injury Sustained During the OEF/OIF Conflicts*. This is an unpublished manuscript provided to us by the Center for the Study of Human Operator Performance (C-SHOP) at the University of Oklahoma. The University of Oklahoma holds the license for ANAM technology.

¹²A false negative is an incorrect result of a diagnostic test or procedure that falsely indicates the absence of a finding, condition, or disease.

¹³A confounding variable is another variable that distorts the association being studied between the two main variables.

¹⁴A false positive is a test result that wrongly indicates the presence of a disease or other condition the test is designed to reveal.

event history, symptoms, and cognitive functioning by means of a neurocognitive assessment tool to determine whether someone has sustained an mTBI.

A third reason experts gave for why they support DOD's policy involves the potential negative effect on the servicemember from a false positive outcome. Most experts told us that individuals who initially test positive for mTBI with a neurocognitive assessment tool—but after further evaluation are determined not to have sustained an mTBI—could still believe they sustained an mTBI and suffer lasting psychological effects from the initial false positive outcome. A few experts disagreed, saying an appropriate explanation by a clinician would likely mitigate any negative psychological effect of a false positive outcome.

Agency Comments

We provided a draft of this report to DOD for comment. DOD concurred with our findings and provided written technical comments, which we incorporated as appropriate. DOD comments appear in enclosure I.

We are sending copies of this correspondence to the Secretary of Defense and appropriate congressional committees. In addition, this correspondence will also be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staffs have any questions regarding this report, please contact me at (202) 512-7114 or williamsonr@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in enclosure II.



Randall B. Williamson
Director, Health Care

Enclosures – 2

List of Requesters

The Honorable Joseph I. Lieberman
Chairman
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Mark Begich
United States Senate

The Honorable Scott P. Brown
United States Senate

The Honorable Richard Burr
United States Senate

The Honorable Saxby Chambliss
United States Senate

The Honorable Tom Coburn
United States Senate

The Honorable Susan M. Collins
United States Senate

The Honorable James M. Inhofe
United States Senate

The Honorable Mark Udall
United States Senate

The Honorable Tammy Baldwin
House of Representatives

The Honorable Sanford D. Bishop Jr.
House of Representatives

The Honorable Tom Cole
House of Representatives

The Honorable Joe Courtney
House of Representatives

The Honorable Mark Critz
House of Representatives

The Honorable Rush Holt
House of Representatives

The Honorable Dave Loebsack
House of Representatives

The Honorable Mike Michaud
House of Representatives

The Honorable Grace F. Napolitano
House of Representatives

The Honorable Bill Pascrell, Jr.
House of Representatives

The Honorable Todd Russell Platts
House of Representatives

Comments from the Department of Defense



OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, DC 20301-1200

HEALTH AFFAIRS

OCT -5 2011

Mr. Randall B. Williamson
Director, Health Care
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Williamson:

Thank you for the opportunity to review the Government Accountability Office (GAO) draft report, "DEFENSE HEALTH CARE: Use of Neurocognitive Assessment Tools in Post-Deployment Identification of Mild Traumatic Brain Injury," dated September 15, 2011 (Job Code: 290921). After careful review, we concur with the report but would like to offer the following technical comments.

(1) The enclosed DoD definition of traumatic brain injury (TBI) should be used and referenced within GAO's report rather than the definition released by the Centers for Disease Control and Prevention discussed in paragraph 1. The DoD definition incorporates pertinent elements of the CDC definition but is targeted specifically to the population that we serve. Within DoD, TBI cases are generally classified as mild, moderate, severe and penetrating. The penetrating category has been omitted from the draft report and is clearly relevant for DoD.

(2) As written, paragraph 3, lines 4 and 5, imply neurocognitive assessment results can help determine whether a mild traumatic brain injury (mTBI) has occurred. Evaluation can be assisted and some mTBI-related impairment can be quantified, but identification of TBI is based on an injury event and alteration or loss of consciousness. Neurocognitive assessments can reveal a change in a cognitive baseline or show cognitive deficits that might be a product of a brain injury, but it is important not to contribute to the common misunderstanding that neurocognitive assessments can detect mTBI. Therefore, we recommend the sentence be changed to one of the following:

- Neurocognitive deficits associated with mTBI can be identified by neurocognitive assessment tools, or
- Symptoms associated with mTBI can be identified by neurocognitive assessment tools.

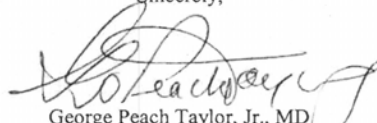
(3) Finally, paragraph 4, sentence 1, again implies neurocognitive assessment tools can detect cases of mTBI in Service members returning from deployment. In an attempt to maintain consistent language throughout the report regarding the function of neurocognitive assessment tools, we offer the following change:

- Identification of mTBI in Service members who served in Afghanistan and Iraq has been the subject of recent media attention, with particular attention focused on the proper use of neurocognitive assessment tools to screen all Service members post-deployment for deficits or symptoms related to mTBI.

Enclosure I

We sincerely thank the GAO for its thorough review and analysis of issues regarding the use of neurocognitive assessment tools in post-deployment identification of mTBI, and look forward to the release of the final report. Questions or concerns regarding this response may be addressed to Ms. Elizabeth Fudge at (703) 578-8596, or elizabeth.fudge@tma.osd.mil.

Sincerely,



George Peach Taylor, Jr., MD
Deputy Assistant Secretary of Defense
Force Health Protection and Readiness

Enclosure:
As stated

Enclosure II

GAO Contact and Staff Acknowledgments

Contact

Randall B. Williamson at (202) 512-7114 or williamsonr@gao.gov

Staff Acknowledgments

In addition to the contact named above, key contributors to this report were Marcia A. Mann, Assistant Director; Lori Fritz; Teresa Tam; and Rasanjali Wickrema. Monica Perez-Nelson provided legal support and Laurie Pachter assisted in the message and correspondence development.

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