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Disclosures:

An abstract related to this work was accepted as the Electrode Store Best Paper Award Fellow Category for the AAP Annual Meeting in February 2009 in Colorado Springs, Colorado. The views expressed herein are the views of the authors and do not necessarily represent the views of the Department of Veterans Affairs or the United States government.

0894-9115/09/8808-0605/0
*American Journal of Physical
Medicine & Rehabilitation*
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DOI: 10.1097/PHM.0b013e3181ae0f83

ORIGINAL RESEARCH ARTICLE

Separating Deployment-Related Traumatic Brain Injury and Posttraumatic Stress Disorder in Veterans

Preliminary Findings from the Veterans Affairs Traumatic Brain Injury Screening Program

ABSTRACT

Hill JJ III, Mobo BHP Jr., Cullen MR: Separating deployment-related traumatic brain injury and posttraumatic stress disorder in veterans: Preliminary findings from the Veterans Affairs traumatic brain injury screening program. *Am J Phys Med Rehabil* 2009;88:605–614.

Objective: Traumatic brain injury in returning Iraq and Afghanistan combat veterans has been the subject of numerous articles by the popular press and congressional inquiries. Recent research has questioned the accuracy of the traumatic brain injury diagnosis in veterans with depression and/or posttraumatic stress disorder and the validity of the Veterans Affairs traumatic brain injury screening tool to identify traumatic brain injury in returning combat veterans.

Design: Medical records of all combat veterans in the Veterans Affairs Connecticut Healthcare System who both screened positive for traumatic brain injury and received clinical evaluation for traumatic brain injury during the first year of the Veterans Affairs traumatic brain injury screening program were reviewed to explore the relationship between posttraumatic stress disorder and self-reported symptoms attributed to deployment-related traumatic brain injury.

Results: Ninety-four combat veterans identified from positive traumatic brain injury screens were seen in the Veterans Affairs Connecticut Healthcare System from April 1, 2007, to March 30, 2008. Eighty-five percent of the veterans with positive screens met the American Congress of Rehabilitation Medicine definition of probable traumatic brain injury. Symptom reporting was similar for veterans with and without a history of traumatic brain injury. Veterans with both posttraumatic stress disorder and traumatic brain injury were more likely to report falling as a mechanism of injury and indicated that they had suffered a head injury during deployment ($P \leq 0.10$). Veterans with both posttraumatic stress disorder and traumatic brain injury reported more exposures and symptoms compared with veterans with a history of traumatic brain injury.

Conclusions: Veterans who screen positive for mild traumatic brain injury by the Veterans Affairs traumatic brain injury screening tool have high rates of posttraumatic stress disorder, which suggests that interdisciplinary rehabilitation teams need to include mental health professionals with expertise in posttraumatic stress disorder. Because both traumatic brain injury and posttraumatic stress disorder are defined, in part, by the same events and the same self-reported symptoms, the Veterans Affairs traumatic brain injury screening tool does not distinguish between these two commonly reported diagnoses in Operation Enduring Freedom/Operation Iraqi Freedom combat veterans.

Key Words: Military Personnel, Veterans Disability Claims, Disability Evaluation, Closed Head Injuries, Brain Injuries, Brain Concussion

Substantial attention has been directed at the apparently high prevalence rates of mild traumatic brain injury (TBI), both in servicemembers in active combat zones and in veterans recently separated from the military.¹ Given the sheer number of military personnel who are or have been deployed overseas since September 11, 2001, including the more than 1.64 million Operation Enduring Freedom and Operation Iraqi Freedom combat veterans,² any uncertainty in diagnosis or impairment in this population will have profound and far-reaching economic, social, political, and medical implications. Unfortunately, as reported in the recent RAND report³ on psychological and cognitive injuries in returning veterans, uncertainty is “certain” for veterans with potential brain injuries, given the lack of objective diagnostic tests for TBI, potential avoidance by veterans to be “labeled” with a TBI diagnosis, and lack of a consistent case definition for combat-associated TBI.

The reported prevalence of mental health conditions is much higher than mild TBI, with 40.8% of active Army soldiers and 52.2% of Army Reserve and National Guard soldiers screening positive for mental health conditions approximately 6 mos after return from deployment.² Research on the rates of mild TBI and posttraumatic stress disorder (PTSD) in returning combat soldiers by Hoge et al⁴ has even suggested that symptom severity in soldiers who reported exposures consistent with mild TBI is better explained by coexisting PTSD. In February 2008, the United States Government Accountability Office issued their report on the progress of the Veterans Affairs (VA) TBI screening program, in place since April 1, 2007.⁵ Among the challenges identified by the United States Government Accountability Office facing VA clinicians who are treating veterans with TBI are: (1) lack of validation of the VA TBI screening tool, adapted from the Defense and Veterans Brain Injury Center (DVBIC) active-duty screening tool, in VA population; (2) lack of any objective tests to identify mild TBI; (3) dual diagnoses with PTSD; (4) potential to avoid “label” of TBI; and (5) work and family conflicts with keeping medical appointments. These concerns were echoed in the RAND report, with the additional concern that methods and resources historically developed for moderate and severe TBI may not be appropriate for mild TBI.³

History of VA TBI Screening Program

The VA TBI screening tool currently in use is a modified version of the Brief TBI Screen (BTBIS) developed by the DVBIC.⁶ A cross-sectional sample of 596 soldiers from Fort Bragg, North Carolina, were given four separate instruments (including the BTBIS) and determined to have a probable TBI

if they answered “yes” to having any injuries during their deployment over the previous 2 yrs (including injury secondary to fragment, bullet, vehicular, fall, explosion) and answered “yes” to self-reported alteration of consciousness and/or loss of consciousness ranging from being “dazed” to loss of consciousness for longer than 20 mins. Participation rates from the various units were reported at approximately 50%, with 83% of the participants interviewed meeting the American Congress of Rehabilitation Medicine and Centers for Disease Control definition of mild TBI.^{7,8}

In addition to two other internally developed instruments, DVBIC researchers used the Neurobehavioral Symptoms Inventory (NSI)⁹ to validate the BTBIS, which was based on 50 patients (62% women, mean age 36.5 yrs) with persistent symptoms (>3 mos) after a diagnosis of TBI. Although the NSI was administered 13.9 mos after the initial event (similar to the returning combat veteran population), all subjects in the original NSI sample were referred for persistent symptoms (ranging from 3 to 52 mos), and all were involved in litigation at the time of the evaluation. It remains to be seen whether the choice of the NSI was the appropriate choice to screen returning combat veterans, particularly, the lack of validation of the NSI in subjects without symptoms and the high percentage of female subjects.

The current VA TBI screening tool consists of five sections and is provided in the Appendix. Briefly, for a veteran to screen positive, he or she must answer “yes” to at least one answer in each section, including (1) a qualifying event; (2) immediate symptoms at the time of the event; (3) problems beginning or worsening after the event; and (4) ongoing, current symptoms within the past week at the time of the screening. The use of current symptoms to define a history of TBI is notably different from most of the current United States TBI surveillance/assessment systems (Table 1).

Because a veteran must report ongoing, current symptoms to screen positive, this suggests that VA is attempting to prioritize care for veterans with possible postconcussion syndrome. Although the six currently accepted general symptom categories for postconcussion syndrome (as defined in the International Classification of Diseases-10) are reflected in sections 3 and 4 of the VA TBI screening tool, the International Classification of Diseases-10 criteria also require a history of “head trauma with loss of consciousness,” not the more general criterion of “being dazed, confused, or seeing stars” currently in use by the DVBIC, Department of Defense (DOD), and VA. Additionally, and more concerning for misclassification, is that these general symptom categories are also the same symptom categories used in both clinical (the hyper-

TABLE 1 Ongoing U.S. surveillance/assessment/research systems case definitions and methods of identification for traumatic brain injury

Traumatic Brain Injury Surveillance/Assessment Systems					
	Veterans Administration TBI Screening Program ⁵	Model Systems TBI System ¹⁰	Surveillance of Central Nervous System Injury ¹¹	Defense and Veterans Brain Injury Center ⁶	Walter Reed Army Institute of Research ⁴
Inception Agency	2007 Veterans Health Administration (VHA)	1987 National Institute for Disability Related Research (NIDRR)	1990 Centers for Disease Control (CDC)	1992 Veterans Affairs Department of Defense	N/A Department of Defense
Method of TBI assessment	Clinician-administered questionnaire	Hospital admission	TBI-related hospital discharge data/direct case reporting by state	Self-administered questionnaire	Self-administered questionnaire
Moderate/severe TBI only	No	Yes	No	No	No
Case definition includes					
Mechanism of injury	Yes	Yes	Yes	Yes	Yes
Alteration/loss of consciousness at time of injury	Yes ^a	Yes ^b	Yes ^c	Yes ^a	Yes ^a
Symptoms beginning or worsening after event	Yes	No	No	No	No
Active, ongoing symptoms around time of screening	Yes	No	No	No ^d	No
^a Includes “being dazed, confused, or seeing stars” and/or “not remembering the injury.”					
^b Includes “loss of consciousness,” “posttraumatic amnesia,” and/or “objective neurological findings.”					
^c Assumed to be part of the ICD-9-CM criteria and is also a criterion used in the cases identified from state registry data.					
^d The BTBIS includes the question “Are you currently experiencing any of the following problems that you think might be related to a possible head injury or concussion?” However, this question is not included in the criteria for a positive TBI screen.					

^aIncludes "being dazed, confused, or seeing stars" and/or "not remembering the injury."

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^cAssumed to be part of the ICD-9-CM criteria and is also a criterion used in the cases identified from state registry data.

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arousal symptom cluster [criterion D] in the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV criteria) and research (PTSD Checklist [PCL-M]) definitions of PTSD.^{12,13} Because the current estimates of PTSD in soldiers who have seen combat in Iraq and Afghanistan range from 16.7% for active-duty soldiers and 24.5% for reservists,² it is likely that the reliance on current symptoms to identify those who need further evaluation by a TBI clinician will result in referral of veterans with PTSD and a history of TBI, rather than veterans with a history of TBI.

In this article, we present the first-year experience of the polytrauma support clinic for the VA Connecticut Healthcare System, the tertiary level of care available to veterans in the VA polytrauma program. As of June 2008, approximately 4500 veterans have enrolled in the VA Connecticut, with almost 2700 veterans receiving care. Connecticut is home to only one active-duty military base (the remainder being Army and Air National Guard, as well as Reserve units); therefore, in contrast to the programs that have produced the majority of published literature on TBI and combat veterans, veterans referred to the VA Connecticut polytrauma program are referred as a result of the VA TBI screening tool and are seen for the first time in outpatient settings. This longitudinal study assesses the baseline characteristics of veterans who were screened positive by the VA TBI screening tool, the relationship between the screening questions and confirmed cases of TBI, and the impact of coexisting PTSD on symptom reporting for veterans with a history of TBI.

METHODS

A retrospective chart review along with electronic record linkage was done for the Operation Enduring Freedom/Operation Iraqi Freedom veterans in the VA Connecticut Healthcare System who screened positive for TBI and received clinical evaluation for TBI during the first year of the VA TBI screening program. All veterans who were evaluated by the VA Connecticut Healthcare System polytrauma program during the first year of the program (April 1, 2007, to March 30, 2008) were available for this study ($n = 115$). Of those veterans, only those who were referred as the result of a positive TBI screen were included in the final sample ($n = 94$), excluding veterans who were seen as a result of direct referral by a clinician and/or active-duty personnel referred for evaluation. This study was authorized by the VA Connecticut Healthcare System Human Investigation Committee.

Definition of TBI

The presence or absence of a probable TBI was determined from a review of the medical records

associated with the veteran's clinical assessment with a psychiatrist, using the same definition from the American Congress of Rehabilitation Medicine and Centers for Disease Control as that employed to define probable TBI by Schwab et al⁶ at the DVBIC when developing the aforementioned BTBIS.⁵ The term deployment-related TBI is used instead of combat-related TBI because some veterans experienced a concussion or TBI while deployed but not as a result of combat. Examples include construction accidents and single-vehicle accidents.

Definition of PTSD

Although many of the subjects in this sample were actively in treatment for a variety of mental health conditions, data abstraction related to mental health was restricted to only those veterans who had been diagnosed with PTSD by Veterans Benefits Association Compensation and Pension reviewers. Although it is possible that other veterans seen in the polytrauma program would have met criteria for PTSD, the determination of service-connected PTSD is done by a qualified clinician with specific training in the use of the DSM-IV criteria to make a determination of PTSD related to a veteran's service history.¹⁴

The subject's VA registration data were used to determine race, marital status, service branch, last service date, and the presence of service-connected PTSD. From our clinical experience, most returning veterans do not remember the specific date(s) of the event related to probable TBI. Therefore, we elected to use the last date of active duty (i.e., separation date) from eligibility records to highlight the delay in obtaining TBI screening; however, the actual event that may or may not have resulted in a concussion/TBI is, in fact, months to years before the veteran's last day of active duty. P values are reported for the unadjusted χ^2 test or Fisher's exact test when the expected cell count was less than five.

RESULTS

General demographic data are presented in Table 2. No subjects were identified in their medical records as having been previously admitted to an inpatient rehabilitation setting for a combat-related TBI. Self-reported race was distributed as follows: white (74.7%), black (10.5%), hispanic/Latino (10.5%), and missing (4.2%). Time from last date of service until screening was greater than 1 yr for both veterans with and veterans without a history of TBI experienced during deployment. Eighty-five percent of the veterans with positive screens met the American Congress of Rehabilitation Medicine definition of TBI. Examples of those veterans who screened positive but did not meet the American

TABLE 2 Subject characteristics, *N* (%)

	All Subjects (<i>N</i> = 95)	Confirmed TBI (<i>N</i> = 81)	No TBI (<i>N</i> = 14)
Male	91 (96)	78 (96)	13 (93)
Age, yrs (mean ± SD)	30.4 ± 7.89	30.3 ± 7.9	30.9 ± 8.1
% Married	29 (31)	26 (32)	3 (21)
Service branch			
Army	33 (35)	28 (35)	5 (43)
Army/Guard	24 (25)	19 (24)	5 (43)
Marine Corps	18 (19)	18 (22)	<i>B</i>
Marine Corps/Reserve	10 (11)	9 (11)	1 (7)
Army/Reserve	5 (5)	4 (5)	1 (7)
Navy/Coast Guard	5 (5)	3 (4)	2 (14)
Combat theater ^a			
Iraq	57 (60)	51 (63)	6 (43)
Afghanistan	20 (21)	14 (17)	6 (43)
Iraq/Afghanistan	6 (6)	6 (7)	
Southeast Asia	4 (4)	3 (4)	1 (7)
Time from last day of active duty until screening, days (mean ± SD)	477 ± 481.7	468 ± 473.7	526 ± 542.3
Contact with a VA mental health provider before TBI screening	50 (53)	40 (50)	10 (71)

^aCombat theater was missing for eight subjects.

Congress of Rehabilitation Medicine definition included cases of heat exhaustion and vasovagal syncope. Only one case met the criteria for moderate TBI (posttraumatic amnesia lasting >24 hrs); all other cases were classified as mild TBI.

Table 3 shows the percentage of veterans who answered “yes” to the primary TBI screening questions (*n* = 94). The most frequent exposure indicated by the entire sample was blast or explosion (80.0%), followed by fall (44.2%). Twenty-five percent indicated losing consciousness at or around the time of the event, with 77.9% reporting alteration in mental status. The most frequent immediate and current symptoms reported by veterans with and without TBI were sleep problems, followed by irritability. Approximately 12% of veterans seen in our clinic reported having a previous DOD diagnosis of TBI and therefore were not required to answer sections 1–4 of the VA TBI screening tool.

Table 4 shows the percentage of veterans who reported ≥3 or more symptoms per section of the VA TBI screening tool. Of note, veterans with both PTSD and TBI reported more symptoms in each section compared with those veterans with only a history of TBI or PTSD. Figure 1*A* and *B* shows the distribution of responses to the VA TBI screening tool between veterans with and without a service-connected PTSD diagnosis, restricted to only those veterans who met the criteria for TBI. Veterans with PTSD and TBI reported higher rates of symptoms in every section, with the exception of balance problems both after the initial event and in the past week and sleep problems within the past week, although the differences were not statistically significant.

Post hoc power analysis, using the variable of “Reporting ≥3 symptoms the week before screening” from Table 4 as the probability of exposure in cases and controls and setting significance at 0.1, indicates that the sample size available for this study gave us a power of 34.5% to detect an 11% difference in reported symptoms between veterans with TBI and veterans with TBI and PTSD.

DISCUSSION

In this study, 85% of veterans with positive TBI screening were determined to have experienced a mild TBI by clinical evaluation, similar to the 83% reported by Schwab et al using the BTBIS. Thirty-five percent of the veterans who screened positive and were evaluated in the polytrauma program had a diagnosis of service-connected PTSD. Veterans with a history of TBI and PTSD reported more events and more immediate, subsequent, and current symptoms compared with those veterans with a history of TBI.

Sleep problems and irritability were reported more often than other symptoms, but this pattern was seen in both veterans with and without clinically confirmed TBI. Veterans who meet criteria for both TBI and PTSD seem to report more symptoms overall; however, this difference is not statistically significant. Although we have been able to separate those veterans with TBI and PTSD by using face-to-face evaluations, it does not seem that the VA primary TBI screen can separate the two conditions because the screening tool relies on a combination of self-reported mechanism of injury and nonspecific symptoms.

These data highlight several concerns related to the care of veterans with mild TBI: (1) the delay

TABLE 3 Distribution of affirmative responses to the VA Primary Screening Tool stratified by confirmed TBI diagnosis

Section	Response	TBI (n = 81)	No TBI (n = 14)	P
Does the veteran have a prior diagnosis of TBI?	■ Yes_____	10 (12)	1 (7)	1.00
Section 1. During any of your OEF/OIF deployment(s), did you experience any of the following events? (check all that apply)	■ Blast or explosion_____	66 (93)	10 (77)	0.103
	■ Vehicular accident/crash_____	34 (48)	7 (54)	0.693
	■ Fragment wound or bullet wound above the shoulder_____	8 (11)	1 (8)	1.00
	■ Fall_____	34 (48)	8 (62)	0.366
	Reported 3 or more exposures	20 (25)	4 (29)	0.746
Section 2. Did you have any of these symptoms IMMEDIATELY afterwards? (check all that apply)	■ Losing consciousness/"knocked out"_____	22 (31)	2 (15)	0.331
	■ Being dazed, confused, or "seeing stars"_____	63 (89)	11 (85)	0.649
	■ Not remembering the event_____	15 (21)	3 (23)	1.00
	■ Concussion_____	13 (18)	1 (8)	0.685
	■ Head injury_____	18 (25)	2 (15)	0.724
Section 3. Did any of the following problems begin or get worse afterwards? (check all that apply)	Reported 3 of more symptoms	20 (25)	2 (14)	0.510
	■ Memory problems or lapses_____	48 (69)	8 (62)	0.749
	■ Balance problems or dizziness_____	25 (36)	4 (31)	1.00
	■ Sensitivity to bright light_____	22 (31)	4 (31)	1.00
	■ Irritability_____	51 (73)	11 (85)	0.500
Section 4. In the past week, have you had any of the symptoms from section 3? (check all that apply)	■ Headaches_____	41 (59)	6 (46)	0.407
	■ Sleep problems_____	57 (81)	9 (69)	0.453
	Reported 3 of more symptoms	51 (63)	6 (43)	0.156
	■ Memory problems or lapses_____	45 (64)	7 (54)	0.539
	■ Balance problems or dizziness_____	16 (23)	2 (15)	0.724
	■ Sensitivity to bright light_____	16 (23)	2 (15)	0.724
	■ Irritability_____	48 (69)	10 (77)	0.745
	■ Headaches_____	34 (49)	7 (54)	0.771
	■ Sleep problems_____	52 (74)	10 (77)	1.00
	Reported 3 of more symptoms	51 (63)	6 (43)	0.156
Service-connected diagnosis of PTSD		28 (35)	5 (36)	1.00

Veterans were given a diagnosis of TBI if the information provided in their specialty clinic records met the American Congress of Rehabilitation definition for traumatic brain injury. One patient met criteria for moderate TBI (loss of consciousness >30 mins, posttraumatic amnesia >24 hrs); all other cases met criteria for mild TBI. *P* values are unadjusted and reported for the chi-squared statistic, with Fisher's exact values reported when expected cell counts were <5.

from last date of service to screening in the Veterans Health Administration, (2) the high rate of coexisting mental health conditions as it relates to the current makeup of the VA interdisciplinary polytrauma rehabilitation teams, and (3) the reliance on immediate symptoms in the VA TBI screening tool to identify those veterans who need further evaluation for late effects of deployment-related TBI.

The delay in screening veterans with a history of TBI is concerning, particularly because most of the current recommendations related to management of postconcussive syndrome include early

education, reassurance, and problem solving within the first 2 wks after the initial event.¹⁵ Additionally, if the veteran is indeed experiencing difficulty with other activities often attributed to a head injury, such as difficulty remembering appointments, paying bills, ability to maintain employment, school performance, or interpersonal relationships, by the time the VA can identify persons at risk, the consequences have likely occurred.

The high rates of PTSD seen in this study (35%) are higher than the currently published rates of PTSD in active-duty soldiers and reservists.

TABLE 4 Distribution of veterans by diagnosis who had ≥ 3 responses per section on the VA primary TBI screening tool

VA Primary TBI Screening Questions	Diagnosis		
	TBI (<i>N</i> = 53)	PTSD (<i>N</i> = 5)	TBI and PTSD (<i>N</i> = 28)
Section 1. Reporting ≥ 3 exposures.	8 (15)	1 (20)	12 (43)
Section 2. Reporting ≥ 3 symptoms at time of event.	9 (17)	1 (20)	11 (39)
Section 3. Reporting ≥ 3 symptoms at after the event.	31 (59)	1 (20)	20 (71)
Section 4. Reporting ≥ 3 symptoms the week before screening.	31 (59)	1 (20)	20 (71)

Veterans who screened positive by an affirmative response on Question 1 "Does the veteran have a prior diagnosis of TBI?" are not included in the analysis because they did not have to provide answers to sections 1–4.

Although this may be a result of the VA TBI screening tool reliance on current symptoms to indicate a positive screen, it is also likely, given that veterans must voluntarily enroll and seek care in the VA, that we are simply seeing a population of veterans with more health concerns, which has led them to enroll. Either way, the fact that almost all of the veterans seen in our program experienced at least one mild TBI (which includes concussion) and that more than one-third of them have a coexisting diagnosis of PTSD, a traditional inpatient rehabilitation team made up of rehabilitation physicians, nursing, physical therapy, occupational therapy, speech language pathology, and neuropsychology may not be the most appropriate group of specialists to address the needs of this population. Efforts are under way within the VA to provide an integrated primary care and mental health clinic for returning combat veterans, and, in light of these findings, one could argue that an integrated rehabilitation and mental health clinic model may better serve this population.

Finally, the decision of VA to use current symptoms to define the veteran population who would benefit from further evaluation in the polytrauma program has numerous ramifications. For non-VA clinicians and researchers, it will continue to be difficult to apply any of the VA research findings on mild TBI to their patient populations because the VA TBI population is defined by a different case definition than that in use by the other United States TBI surveillance systems, including the Centers for Disease Control and Prevention and Model Systems data. Additionally, the high rates of PTSD in the VA TBI population and the most commonly reported mechanism of injury (i.e., blast) are not consistent with civilian populations. Although the VA is using a more comprehensive TBI screening tool (in use since October 2007) once the veteran is referred to a polytrauma clinic, because the veteran is identified by the VA TBI screening tool, this secondary screening process will

also be difficult to interpret and will not address the overlap between PTSD and TBI symptoms.

Despite the above limitations, the VA TBI screening tool is now included in the DOD Postdeployment Health Assessment (DD 2796) to assess TBI, with the addition of tinnitus in the symptom list.¹⁶ DOD clinicians are instructed to determine whether the soldier is at risk for a TBI (based on the answers to the four questions) but only instructs the clinician to refer the soldier for further evaluation if he or she has a potential TBI with persistent symptoms (positive response to "In the past week, have you had any of the symptoms previously indicated?"). This seems counter to the definition of TBI adopted by the DOD and the definition used to validate the BTBIS, which is based solely on the exposure to an external force and immediate signs/symptoms at the time of the injury (loss of consciousness, memory loss, confusion etc.)¹³ This is of increased concern, because the recent Institute of Medicine report on long-term consequences of TBI recommends that the DOD use the BTBIS as part of the evaluation process for soldiers with a history of blast exposure.¹⁷

Strengths of this study include a complete census for all veterans in a specified geographic area, standard case definition based on exposure, and the use of a specialty clinical evaluation to determine both a diagnosis of deployment-related TBI and a diagnosis of PTSD. Limitations include the inability to clinically assess those veterans with a positive screening tool who had the exposure (positive responses to the first two questions) but denied any of the six symptoms choices. Although these records are potentially available, without the gold standard of a clinical evaluation to diagnosis TBI, we (and VA) are unable to determine the number of false negatives in this population.

In closing, the care of our returning combat veterans who may have suffered a previous mild

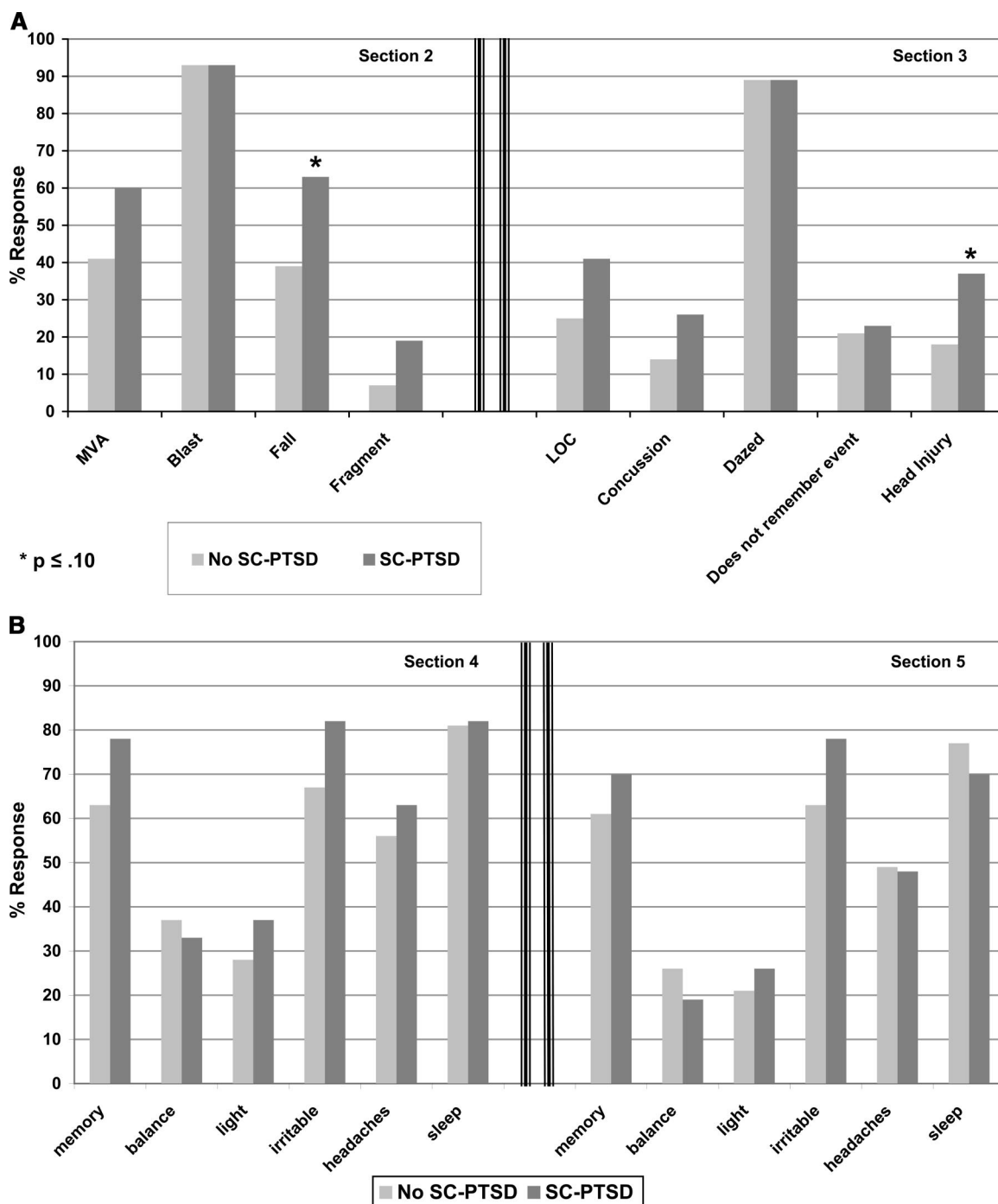


FIGURE 1 Distribution of affirmative responses to the VA Primary Screening Tool stratified by service-connected PTSD diagnosis. Analysis is limited to only those veterans who had a confirmed TBI diagnosis. Veterans who screened positive by an affirmative response on Question 1: "Does the veteran have a prior diagnosis of TBI?" are not included in the analysis as they did not have to provide answers to Sections 1–4 ($N = 70$). P values are unadjusted.

TBI is complicated by (1) the delay from last date of service to screening in the Veterans Health Administration; (2) the high rates of coexisting mental health conditions; and (3) the reliance on immediate symptoms in the VA TBI screening tool to identify those veterans who need further evaluation for late effects of deployment-related TBI. Given

that most veterans at risk for deployment-related concussion/TBI will likely be mild TBI and evaluated in outpatient settings of the 5852 United States ARMY-reported TBI cases as of August 2008, 5150 (88.0%) were counted as mild the type of resources, clinical guidelines, and screening procedures that the VA adapted from the acute inpatient

TBI rehabilitation model may not be adequate for this population.¹⁸

ACKNOWLEDGMENTS

We thank John E. Beauvais, PhD, and Martin D. Slade, MPH, for their review and assistance with this manuscript, as well as the members of the Polytrauma Support Clinic for the Veterans Affairs Connecticut Healthcare System.

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APPENDIX

TABLE A1 VA Primary TBI screening tool questions

- 1) Does the veteran have a prior diagnosis of TBI?
- 2) During any of your OEF/OIF deployment(s), did you experience any of the following events?
 - Blast or explosion
 - Vehicular accident/crash
 - Fragment wound or bullet wound above the shoulder
 - Fall
- 3) Did you have any of these symptoms IMMEDIATELY afterward?
 - Losing consciousness/"knocked out"
 - Being dazed, confused, or "seeing stars"
 - Not remembering the event
 - Concussion
 - Head injury
- 4) Did any of the following problems begin or get worse afterward?^a
 - Memory problems or lapses
 - Balance problems or dizziness
 - Sensitivity to bright light
 - Irritability
 - Headaches
 - Sleep problems
- 5) In the past week, have you had any of the symptoms from the previous section?^a
 - Memory problems or lapses
 - Balance problems or dizziness
 - Sensitivity to bright light
 - Irritability
 - Headaches
 - Sleep problems

^aThe DOD Form DD2796 has added "ringing in the ears" to questions 4 and 5.