

Consistency of Recall for Deployment-Related Traumatic Brain Injury

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Objective: To examine the temporal consistency of self-reported deployment-related traumatic brain injury (TBI) and its association with posttraumatic stress disorder (PTSD) symptom severity. **Setting:** In-person interviews at US Army installations (postdeployment); phone interviews (long-term follow-up). **Participants:** A total of 378 US Army soldiers and veterans deployed to Iraq; 14.3% ($n = 54$) reported TBI with loss of consciousness during an index deployment. **Design:** Participants were evaluated after returning from deployment and again 5 to 9 years later. **Main Measures:** Temporal consistency of TBI endorsement based on TBI screening interviews; PTSD Checklist, Civilian Version. **Results:** The concordance of deployment-related TBI endorsement from the postdeployment to long-term follow-up assessment was moderate ($\kappa = 0.53$). Of the 54 participants reporting (predominantly mild) TBI occurring during an index deployment, 32 endorsed TBI inconsistently over time. More severe PTSD symptoms at postdeployment assessment were independently associated with discordant reporting ($P = .0004$); each 10-point increase in PCL scores increasing odds of discordance by 69% (odds ratio = 1.69; 95% confidence interval, 1.26-2.26). **Conclusions:** Deployment-related TBI may not be reported reliably over time, particularly among war-zone veterans with greater PTSD symptoms. Results of screening evaluations for TBI history should be viewed with caution in the context of PTSD symptom history. **Key words:** OIF, PTSD, recall consistency, TBI screening, traumatic brain injury

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TRAUMATIC BRAIN INJURY (TBI) has been described as a hallmark injury of Operation Enduring Freedom and Operation Iraqi Freedom (OEF/OIF).¹ Screening for deployment-related TBI has therefore become a cornerstone in the clinical care of OEF/OIF veterans. Because deployment-related TBI events are not necessarily captured in military health records and witness reports are often rare, clinicians must typically rely on the veteran to provide an accurate recall of deployment TBI history. For those with multiple deployments, the time elapsed since the deployments and the stressful and chaotic circumstances of many of the deployment events that lead to TBI, self-report of specific TBI events may prove challenging. Inconsistent recall of TBI history

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is concerning to clinicians, who are often evaluating a potential TBI months or years after the event, because it can preclude accurate diagnostic and treatment formulation. The purpose of this study was to examine the consistency of deployment-related TBI recall over time.

Literature examining the recall stability of war-zone events indicates that a broad range of war-zone events may not be recalled consistently. For example, Wessely et al² found that reports of deployment exposure to military hazards (eg, combat, environmental hazards, and toxins) increased over 3 years postdeployment among a sample of 2370 UK Gulf War veterans. Similar recall discrepancies of psychologically stressful deployment events emerge in other war-zone veteran samples.^{3,4} Findings linking posttraumatic stress disorder (PTSD) symptoms to inconsistent recall of war-zone events suggest that emotional distress may, in part, influence recall of stressful events potentially encountered in the war zone.^{4,5}

War-zone TBI, by definition, at least transiently disrupts brain functioning and is associated with alterations of consciousness. Moreover, war-zone TBI events often occur within the context of significant psychological stress and may likewise lead to neurobiological alterations that further alter encoding processes.⁶ As such, it is possible that recall of TBI war-zone events is affected by faulty retrieval due to impoverished encoding at the time of the event. Although research examining the consistency of deployment-related TBI endorsement is limited, studies examining the temporal reliability of both paper-and-pencil and interview-based screening determinations within Veterans Health Administration (VHA) clinical settings suggest that war-zone veterans may not recall TBIs consistently over time. For example, Vanderploeg and Belanger⁷ administered paper-and-pencil TBI screenings to 95 OEF/OIF veterans at 24 months, 25 to 38 months, and 38 to 57 months after an initial interview-based VHA TBI Clinical Reminder. Positive rates of TBI history more than doubled at the longest interinterval screening assessment, relative to the original screening. Van Dyke et al⁸ examined the reliability of VHA interview-based screening determinations documented in VHA electronic medical records among 44 OEF/OIF veterans who had endorsed at least 1 item on the VHA Traumatic Brain Injury Screening Instrument during its initial administration. They reported that most types of TBI events were recalled unreliably over a 6-month interval. In a study examining TBI reporting more proximal to deployment and associated TBI events in 953 National Guard soldiers deployed to Iraq, Polusny et al⁹ found that positive TBI affirmation on mail questionnaires increased nearly 2-fold from in-theater assessment to 1 year postdeployment.

In the current study, we extend the literature by examining the stability of TBI endorsement across 2 assess-

ment episodes, separated in time by several years. More specifically, we examined the endorsement or nonendorsement of (predominantly mild) deployment-related TBI incurred during a specific deployment in a sample of non-treatment-seeking OIF veterans for whom archived structured TBI screening interview data were available as part of a longitudinal research study. Discordance (ie, reporting that a TBI occurred during the index deployment at only 1 of the 2 assessments) was determined from interviews obtained (a) shortly after participants returned from the index deployment and (b) during a long-term follow-up assessment conducted approximately 5 to 9 years later.

On the basis of prior research demonstrating that endorsement of both non-TBI war-zone events²⁻⁴ and TBI events⁷⁻⁹ is unstable and tends to increase over time, we hypothesized that participants would exhibit instability in temporal recall of deployment-related TBI, with endorsement rates of TBI increasing over time. Previous findings also indicate that PTSD is strongly associated with the consistency of recall of war-zone events,^{4,5} including TBI.⁷⁻⁹ Therefore, we examined the relation between PTSD symptom severity and the concordance of TBI endorsement, hypothesizing that discordance of deployment-related recall would be associated with more severe PTSD symptoms at both assessments, even after adjusting for age and subsequent deployment history. Although a broad range of factors could be theorized to exert incremental effects on recall, we limited covariate inclusion in the model to age and subsequent deployment history to maintain model parsimony and optimize statistical reliability.¹⁰ Age was prioritized because of its normative effects on memory.¹¹ We reasoned that interim deployments occurring between the postdeployment and long-term assessments would increase the likelihood of the participant incurring additional deployment TBIs, therefore experiencing more difficulty in linking TBI events to specific deployments.

METHODS

Participants

Figure 1 depicts the sample derivation. Participants were 378 military service members/veterans drawn from a larger sample of OIF veterans who participated in a Department of Veterans Affairs (VA) Cooperative Studies Program study designed to examine long-term neuropsychological and mental health consequences of operational deployment to Iraq. All participants had also previously been evaluated as part of a longitudinal study that incorporated neuropsychological and emotional assessment of regular active duty and activated National Guard Army soldiers before ("predeployment") and after

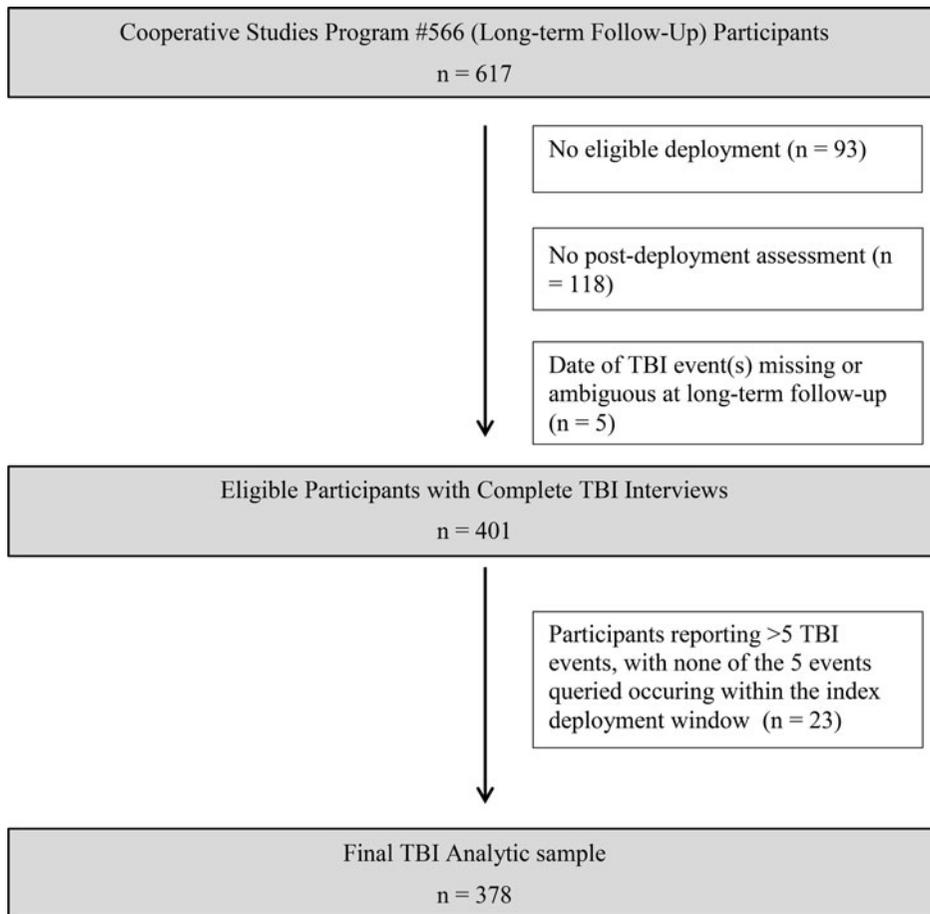


Figure 1. Sample derivation. At long-term follow-up, participants were asked to describe their 5 most significant lifetime TBI events. If the 5 described events occurred outside of the index deployment window, we did not include these cases in the analyses, as it was not possible to determine whether or not additional events occurred during the index deployment. TBI indicates traumatic brain injury.

(“postdeployment”) an index deployment to Iraq occurring between 2003 and 2006. The original sampling at predeployment was conducted at the battalion level, with units selected on the basis of battalion deployment schedules and function such that units represented combat arms (eg, infantry), combat support (eg, combat engineers), and service support (eg, supply) functions. Postdeployment assessments were conducted at military installations an average of 3.3 months (SD = 1.8 months; range, 1.3-10.8 months) following return from deployment. Sampling for the long-term follow-up assessment was conducted in sequential waves over 5 years and was stratified by postdeployment battalion to avoid unit by time (since return from index deployment) confounds. Participants in the long-term follow-up study were evaluated by mail-in questionnaires and phone interviews an average of 7.5 years (SD = 1.0 years; range, 5.4-9.2 years) following their earlier postdeployment evaluation.

Inclusion in the current study required (1) an index deployment to Iraq between 2003 and 2006 and (2) completion of a TBI screening interview and assessment of psychological constructs at both the earlier postdeployment and long-term follow-up assessments. To ensure temporal comparison of the appropriate TBI event, potential participants were not included in the analytic sample if they provided ambiguous or no chronological information related to an endorsed index deployment TBI.

Participants provided written consent at initial enrollment and phone consent at long-term follow-up. As part of the research study, responses were kept confidential. Human subjects’ approvals for the postdeployment assessment were obtained from US Army, Tulane University Health Sciences Center, and VA review boards. Human subjects’ approval for the long-term follow-up assessment was obtained from the VA Central institutional review board.

Measures

Demographics and military history

Demographic data and military history were obtained from written survey questions. Deployment history and military duty status (ie, regular active duty, reservist, military veteran) were verified by service records.

TBI screening interviews

At each assessment, TBI screening questions were administered in interview format. Although questions were highly structured, both participants and examiners were permitted to ask questions or provide further clarification about either the question or the response. Reflecting the evolution over the course of the Iraq War of increasing focus on the full range of deployment TBI events, including those without loss of consciousness (LOC), the TBI screening interviews varied slightly with regard to TBI without LOC and number of events queried across postdeployment and long-term follow-up assessments.

At postdeployment assessment, and congruent with reports showing stronger associations between clinical outcomes and TBI following LOC versus altered consciousness,^{12,13} only those pre- to postdeployment interval injuries resulting in LOC were queried (“Since {month/year of predeployment assessment}, did you suffer a head injury in which you lost consciousness, or were “knocked out?”). Response options included “yes, once,” “yes, more than once,” “no,” and “not sure.” The interview was discontinued with a “no” response. Following a positive endorsement, subsequent questions pertained to the characteristics (eg, duration of LOC and posttraumatic amnesia; not considered in this report due to an insufficient number of observations within each level) and the month/year of the most significant injury, as identified by the participant.

At long-term follow-up, although participants were asked about lifetime history of TBI, we considered only endorsement or nonendorsement of TBI during the index deployment in our analyses of concordance. TBI was defined by a “head injury or close exposure to explosive blasts” that resulted in at least one of the following: altered consciousness (explained as “dazed” or “knocked out altogether”), loss of memory “for what was happening during, immediately before, or immediately after the injury or explosion,” “seizures,” or “brain surgery.” The interview was discontinued following a “no” response. A positive endorsement was followed by a query regarding the number of lifetime injuries meeting these criteria (1, 2, 3, 4, 5, or >5). Follow-up questions for the 5 most significant events as defined by the participant pertained to injury characteristics, including whether the participant suffered LOC (“Did you lose consciousness

or did you get knocked out?”), with response options of “no,” “yes,” or “unknown.” In addition, participants provided the month and year of each event, also indicating for each event whether it was experienced during a deployment and whether it represented their most significant TBI.

Because we did not capture TBI without LOC at postdeployment assessment, only those index deployment TBIs reported at long-term follow-up as being accompanied by LOC were considered in the analyses. In addition, if a participant reported experiencing more than 5 TBIs at long-term follow-up, but none of the 5 TBIs described at long-term follow-up reflected a TBI occurring during the earlier pre- and postdeployment assessment TBI reporting interval, we did not include the participant in the analyses. We reasoned that in such cases we could not determine whether the participant, had they been given the opportunity at long-term follow-up to describe more than 5 lifetime events, would have reported a TBI pertinent to the index deployment.

Temporal *concordance* was defined as (a) a TBI with LOC within the index deployment time frame endorsed at both postdeployment and long-term follow-up assessments or (b) lack of endorsement at both assessments of a TBI with LOC during the index deployment time frame. All other recall patterns in relation to a TBI event occurring within the index deployment time frame (ie, endorsement at postdeployment assessment/nonendorsement at long-term follow-up, nonendorsement at postdeployment assessment/endorsement at long-term follow-up) were considered to reflect temporal *discordance*.

PTSD symptom severity

PTSD symptom severity was measured with the PTSD Checklist, Civilian Version (PCL-C).¹⁴ Respondents rate 17 items corresponding to *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*,¹⁵ PTSD symptom criteria on a 1- to 4-point scale of severity, yielding a summary score ranging from 17 to 85. The internal consistency of the PCL-C at the postdeployment and long-term follow-up assessments was high (Cronbach α = 0.93 and 0.96, respectively).

Interrater reliability

Before examining the temporal consistency of TBI recall, we first determined the interrater reliability of the TBI screening interview for the long-term follow-up assessment. To do so, we audio-recorded the phone interviews at long-term follow-up and randomly selected approximately 10% of these for consideration of interrater reliability. (Because the postdeployment assessment was conducted as a field research study at military installations, we were not able to audiotape

the postdeployment TBI interviews.) A clinical neuropsychologist with more than 10 years postdoctoral professional experience, including the evaluation of individuals with deployment-related TBI, then independently coded the audio-recorded participant responses to the interview in the reliability sample. We examined the interrater reliability of the following lifetime history variables: any lifetime TBI (yes/no), any lifetime TBI with LOC (yes/no), and number of lifetime TBIs (1, 2, 3, 4, ≥ 5). For the event designated by the participant as the most serious, we examined the reliability of associated LOC (yes/no/unknown), length of LOC (≤ 30 minutes, > 30 minutes, unknown), ability to recall the events (yes/no/unknown), and duration of posttraumatic amnesia (≤ 24 hours, > 24 hours). For the most recent deployment-related TBI, we examined the reliability only of whether the event was associated with LOC but did not consider other characteristics due to insufficient observations within some cells.

Data analysis

Analyses were conducted using SAS, version 9.2 (SAS Institute Inc, Cary, North Carolina). At the postdeployment assessment, 14 participants (3.7%) were missing specific items on the PCL-C (range, 1-5 items missing); at the long-term follow-up assessment, 6 participants (1.6%) were each missing 1 PCL item. Therefore, no participant included in the analytic sample had more than 5 PCL items (29.4% of the 17-item scale) missing at any time point. Missing values for the PCL-C were imputed using the mean value of each participant's completed items. Both interrater reliability and temporal concordance of TBI endorsement were examined using κ statistics.

We examined the relation of PTSD symptom severity to temporal discordance, adjusting for age at follow-up assessment and subsequent deployment (ie, whether or not the participant deployed at least once more after the index deployment), using logistic regression. Odds ratios describe the impact of each variable on the outcome variable (temporal discordance), accounting for all other variables in the model. To enhance the clinical interpretation of findings, the model examined 10-point incremental changes on the PCL-C in relation to discordance. Cases were deleted list-wise in regression analyses when values were missing.

RESULTS

Sample characteristics

The characteristics of the sample, including demographics and military information, PCL scores, and descriptive TBI information, are described in Table 1. Consistent with other studies,¹⁶⁻¹⁸ of the 378 participants,

54 (14.3%) reported a TBI with LOC within the index deployment window at the postdeployment assessment and/or the long-term follow-up deployment.

Interrater reliability of TBI screening interview questions

Interrater reliability at long-term follow-up was high for TBI lifetime variables (lifetime TBI, lifetime TBI with LOC, and number of lifetime TBIs; $\kappa = 0.97, 0.97,$ and 0.92 , respectively); variables pertaining to the most serious event (associated LOC, length of LOC, recall of the event, and duration of posttraumatic amnesia; $\kappa = 1.00, 1.00, 1.00,$ and 0.95 , respectively); and whether the most recent deployment-related TBI was associated with LOC ($\kappa = 1.00$).

Temporal consistency of TBI reporting

At postdeployment assessment, 32 participants (8.5% of the overall sample) reported experience of at least one TBI with LOC during the index deployment time frame (pre- to postdeployment assessment); at long-term follow-up, 44 participants (11.6% of the overall sample) reported experience of at least one TBI with LOC during the index deployment time frame. The concordance of endorsement/nonendorsement of an index deployment TBI with LOC across postdeployment and long-term follow-up assessments was moderate ($\kappa = 0.53$). Inspection of the data revealed that 91.5% ($n = 346$) of the sample was consistent over time in their report of whether or not they experienced a TBI during the index deployment window. Of the 54 participants reporting a TBI during the index deployment, 32 (59.3%) provided inconsistent reports over time. Of the 32 participants with inconsistent TBI reports, 68.8% ($n = 22$) changed their report from "no" at postdeployment assessment to "yes" at long-term follow-up assessment whereas 31.3% ($n = 10$) changed their report from "yes" at postdeployment assessment to "no" at long-term follow-up. Logistic regression (see Table 2) revealed that postdeployment PTSD symptom severity—as measured by PCL summary scores—significantly predicted reporting consistency, after accounting for age at long-term follow-up assessment, subsequent deployment following the index deployment, and PCL scores at long-term follow-up. For every 10-point increase on the PCL, the odds of discordant TBI responses increased by 69% (odds ratio = 1.69; 95% confidence interval, 1.26-2.26; $P = .0004$).

DISCUSSION

The accurate report of historical TBI events establishes a foundation upon which subsequent prognosis and etiological attribution of ongoing—and often nonspecific—somatic and cognitive symptoms experienced by many war-zone veterans can be made. In

TABLE 1 *Sample characteristic (N = 378)^a*

Sample characteristics	n (%)	M (SD)
Age at follow-up assessment, y		35.1 (5.99)
Education at follow-up assessment		
High school/high school equivalent	88 (23.7)	
Part college	210 (56.4)	
College or higher	74 (19.9)	
Missing	6	
Sex		
Female	21 (5.6)	
Male	357 (94.4)	
Race/ethnicity		
White	255 (67.5)	
African American	42 (11.1)	
Hispanic American	43 (11.4)	
Other	38 (10.0)	
Military occupational type at postdeployment assessment		
Service support	148 (39.1)	
Combat support	43 (11.4)	
Combat arms	187 (49.5)	
Rank at postdeployment assessment (using pay grade)		
Officer (commissioned or warrant)	12 (3.2)	
Noncommissioned officers (E5-E9)	188 (49.7)	
Junior enlisted (E1-E4)	178 (47.1)	
Index TBI attributes reported at postdeployment assessment (n = 32) ^b		
>1 TBI	8 (3.2)	
LOC ≤30 min	29 (90.6)	
LOC >30 min	2 (6.3)	
LOC, not sure of duration	1 (3.1)	
Remembers injury event	23 (71.9)	
Posttraumatic amnesia, ≤24 h	11 (34.4)	
Posttraumatic amnesia, >24 h	2 (6.3)	
PCL-C summary score, postdeployment		32.0 (12.6)
PCL-C summary score, long-term follow-up		36.8 (16.7)
Missing	9	
≥1 deployment subsequent to index deployment	216 (57.1)	

Abbreviations: LOC, loss of consciousness; PCL-C, PTSD Checklist, civilian version; PTSD, posttraumatic stress disorder; TBI, traumatic brain injury.

^aSample size varies slightly across variables due to missing data, indicated as applicable. Percentages are based on the sample with available data for each variable.

^bData are expressed as number (%) of only those participants reporting TBI at postdeployment assessment.

TABLE 2 *Adjusted associations of age (at long-term follow-up assessment), intervening deployments, and PTSD symptom severity, with temporal discordance of TBI report (N = 378)*

Variable	OR (95% CI)	P
Age at long-term follow-up assessment, y	0.98 (0.92-1.05)	.51
Deployment TBI subsequent to index deployment	1.17 (0.54-2.54)	.97
PCL-C summary score (in 10-point increments), postdeployment assessment	1.69 (1.26-2.26)	.0004
PCL-C summary score (in 10-point increments), long-term follow-up assessment	1.00 (0.78-1.29)	.96

Abbreviations: CI, confidence interval; OR, odds ratio; PCL-C, PTSD Checklist, civilian version; PTSD, posttraumatic stress disorder; TBI, traumatic brain injury.

clinical settings, however, deployment TBI history frequently relies heavily on self-report. Often solicited months or years after the event, self-report potentially becomes vulnerable to reporting bias and memory retrieval failures, diminishing confidence in diagnostic appraisals. This study incorporated analysis of longitudinal TBI screening data collected as part of a broader longitudinal deployment mental health study on 378 US Army soldiers and military veterans who had been deployed to Iraq. Findings revealed moderate temporal consistency across the entire sample. However, among participants who reported a TBI at an assessment conducted soon after their return from an index deployment to Iraq and/or at a long-term follow-up conducted several years later, more than half were inconsistent in their endorsement of TBI across time.

Although the majority of discordant reporters (69%) changed their report from nonendorsement to endorsement, a significant subset of reporters (31%) changed their report from endorsement to nonendorsement, suggesting that temporal reporting inconsistency in this sample reflected a more general instability of recall as opposed to a directional reporting bias that increased with time. This pattern of responding is similar to that found in previous work that also demonstrated substantial instability of TBI reporting over time, albeit with a greater tendency to endorse higher rates of TBI with the passage of time.⁷ Polusny et al⁹ also found increased endorsement of deployment-related TBI history over time, although that study was unidirectional and only targeted increased endorsement of TBI over time rather than overall instability. Past work also demonstrates overall instability of non-TBI war-zone events, including, but not limited to, high rates of increased reporting over time.²⁻⁴

Temporal instability of TBI recall: Relation to PTSD

We also found that discordance was higher among participants with more severe postdeployment PTSD symptoms after adjusting for age, number of deployments, and current PTSD symptoms, suggesting that PTSD symptoms experienced near the time of injury may contribute to TBI reporting inconsistency. Both PTSD and TBI are highly comorbid in OEF/OIF military personnel,^{17,19} likely in part because deployment TBI often occurs in the context of psychological exposure to discrete and/or repetitive life-threatening events. Past work showed that endorsement of combat events became less consistent as PTSD symptoms increased over time among OIF and Gulf War veterans.^{3,20} Surprisingly, PTSD symptom severity at long-term follow-up was not significantly associated with response inconsistency in either adjusted or unadjusted analyses. This finding runs counter to conventional wisdom that cur-

rent distress negatively biases retrospective reports of war-zone events.

It could be speculated that PTSD symptoms experienced during or after deployment influence reporting via psychological mechanisms such as attempts to minimize distress by avoiding thinking about stressful war-zone events, including those leading to TBI. If such avoidance were to resolve over time, nonendorsement of stressful TBI events would be expected to correspondingly change to TBI endorsement.²¹ Conversely, in some war-zone veterans, overendorsement of events may stem from a bias to attend preferentially to perceived threat, including threat to one's physical well-being from somatic conditions such as TBI.²² Endorsement due to focused attention to—and concern about—somatic conditions might be expected to change with PTSD symptom reduction.²³ This is consistent with studies indicating attentional bias to physical symptoms in individuals with PTSD and other anxiety disorders.²⁴ Finally, it may be that emotional distress during potentially traumatic events influences the quality of encoding and subsequent reconstruction of the events from memory.²⁵ We did not have a sufficient number of observations of inconsistent TBI reports to examine PTSD symptoms at each time point in relation to the direction in which TBI report changed over time, but this would be a productive area for future research.

Temporal instability of TBI recall: Other considerations

There are several additional possible explanatory factors for overall discordant reporting of TBI history over time. First, alterations in consciousness during and immediately after the TBI can interfere with memory encoding,²⁶ which can adversely affect subsequent recall of the TBI event. Alternatively, TBI may result in chronic, ongoing cognitive deficits that degrade retrieval.²⁷ This possibility, however, is less likely, given that most of our sample participants reported mild TBI and the cognitive sequelae of mild TBI are typically (albeit not universally) short-lived.²⁸ It is also possible that as service members deploy multiple times, it becomes difficult—especially for milder injuries not requiring immediate care—to correctly attribute a TBI to a specific deployment. However, our results suggested that multiple deployments did not result in greater risk of unreliable TBI recall. Other potential reasons for reporting inconsistency include differential levels across time of exposure and sensitization to TBI via secondary sources (eg, media),²⁹ secondary gain (eg, financial disability-based compensation), and, conversely, incentives to underreport (eg, concerns about deployment eligibility and military career advancement).

Although we could not control for increasing public sensitization to TBI, the confidentiality of responses within the research context would be expected to mitigate external incentives to over- or underreport. Finally, reporting inconsistency may reflect psychometric attributes of the measure used to elicit TBI history. Given the static nature of TBI history and the overall adequate psychometric properties of similar measures,³⁰⁻³² however, inconsistencies in reported TBI history on screening measures, particularly across long-term intervals, is likely not a psychometric consequence. The diagnostic accuracy of TBI screening instruments is also reduced in the presence of PTSD symptoms among veterans, further suggesting that difficulties in recall of deployment TBI is more complicated than a psychometric problem alone.³⁰

Clinical implications

The current findings have several clinical implications. First, the results suggest that for deployment-related mild TBI, history of deployment TBI cannot be presumed to be accurate if based on a brief screening alone. Despite use of clarifying follow-up questions at both assessments in the study, temporal consistency was only modest. Although TBI screening instruments are characterized by good diagnostic efficiency³¹ and are efficient to administer in high-volume clinical settings, TBI screening instruments (like other screening tools) benefit from being supplemented by clinician-guided assessments that permit probing of details. In particular, open-ended questions with follow-up probes may reduce response biases that are sometimes associated with structured questions while facilitating capture of injury detail.⁷ Results suggesting an association between PTSD symptoms and reporting inconsistency also highlight the importance of assessing TBI in the context of psychiatric history, particularly of PTSD and other war-zone stress reactions.

Study limitations

Although findings provide a rare longitudinal perspective on TBI reporting consistency, results of this study should be interpreted with recognition of its limitations. This study examined only OIF veterans, and it is unclear whether our findings generalize to civilian populations or veterans of other wars. TBI risk also differs according to when and where service members were deployed within the OEF/OIF context and according to the mission and occupational composition of the sample deployed; however, the incidence of TBI in our sample appears to be within the range typically reported (eg, 10% in a large Florida National Guard sample,¹⁶ and 23% in a sample of regular active duty US Army

soldiers exposed to combat¹⁷). The observed value of 14.3% is comparable with an early OEF/OIF population estimate of 19% prevalence based on a probability sample, and capturing cumulative TBI exposure across multiple deployments, as applicable.¹⁸

Regarding measures and statistical considerations, PTSD symptom severity was assessed by a well-validated PTSD symptom checklist but did not include structured diagnostic interviewing or assessment of the full range of PTSD diagnostic criteria, including the trauma event and clinical impairment. Although the TBI interviews at postdeployment assessment and long-term follow-up shared comparable core components and questions, they were not identical in terms of the broader set of questions asked. Although our overall sample size was relatively large, there was a modest number of TBI observations. Consequently, to increase statistical reliability,¹⁰ we did not adjust for a broader range of potential covariates in our statistical model. The current study also required LOC for our case definition of TBI, potentially resulting in overestimation of concordance. That is, it could be argued that LOC decreases the ambiguity of whether a TBI was sustained, relative to alteration of consciousness without LOC. Previous work⁸ examining the test-retest reliability of the Traumatic Brain Injury Screening Instrument, for example, showed that an amnesia item was associated with poorer reliability ($\kappa = 0.16$) than an LOC item ($\kappa = 0.31$).

Finally, the long interval between assessments does not allow for conventional assessment of test-retest reliability but is a unique aspect of this study that, in many ways, mimics clinical care while building on the existing body of work examining consistency of reporting across shorter intervals. Furthermore, understanding TBI reporting consistency over longer intervals is a necessary step in addressing gaps in knowledge regarding the long-term outcomes of TBI and other aspects of OEF/OIF deployment, as reflected in a recent Institute of Medicine report.³³

CONCLUSIONS

Veterans of recent military conflicts show only limited consistency across time in their endorsement of deployment-related TBI history. This particularly holds true for those participants who experienced more severe PTSD symptoms upon return from the war zone. Increased clinician awareness of discordant reporting of deployment TBI history may help minimize risk for misdiagnosis and associated flaws in treatment formulation. Future work is needed to clarify mechanisms and risk factors of inconsistent reporting of deployment-related TBI history.

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