

ORIGINAL ARTICLE

Validating the Traumatic Brain Injury-4 Screening Measure for Veterans Seeking Mental Health Treatment With Psychiatric Inpatient and Outpatient Service Utilization Data



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Abstract

Objective: To determine whether a positive screen on the Traumatic Brain Injury-4 (TBI-4) can be used to identify veterans who use more inpatient and outpatient mental health services.

Design: Validation cohort.

Setting: Medical center.

Participants: Individuals seeking Veterans Health Administration mental health services (N = 1493).

Interventions: Not applicable.

Main Outcome Measures: One year of inpatient and outpatient mental health utilization data after the TBI-4 screen date.

Results: In the year postmental health intake, those who answered positively to any of the 4 TBI-4 screening questions (criterion 1) or question 2 (criterion 2; ever having been knocked out) had significantly more psychiatric hospitalizations than those who met neither criterion. Those who were positive by criterion 2 also had significantly fewer outpatient mental health contacts.

Conclusions: Veterans screening positive for history of traumatic brain injury on the TBI-4 had more hospital stays in the year postmental health intake. Those who reported having been knocked out also had fewer outpatient mental health visits. These findings may suggest an overall relation in this population between greater needs for mental health care and likelihood of prior injury. For those with a history of loss of consciousness, the reduced use of outpatient care may reflect greater problems engaging in treatment or with preventive aspects of the health care system during non-crisis periods. Using a screener (eg, the TBI-4) could facilitate identification of veterans who might benefit from targeted and intensive outpatient interventions to avoid frequent inpatient psychiatric hospitalization.

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Mental health problems are one of many possible sequelae of traumatic brain injury (TBI).^{1,2} This is particularly relevant in Veterans Health Administration (VHA) settings where a high number of veterans access mental health services³ and/or have a history of TBI.⁴ Brenner et al⁴ found that 45% of those seeking mental health services at one Veterans Affairs medical center reported a lifetime history of probable TBI. Related findings also suggested that almost one third of veterans seeking mental health services had a lifetime history of moderate-to-severe TBI.⁴ Nevertheless, data regarding the prevalence of TBI among patients in VHA mental health settings remains sparse. This is in part related to the lack of screening tools available to aid in the identification of lifetime history of TBI among veterans from all cohorts.

To address this need, a TBI screen, the Traumatic Brain Injury-4 (TBI-4), was developed and implemented in a Veterans Affairs mental health clinic.⁴ In developing the tool, Brenner⁴ incorporated findings that highlight challenges associated with screening for TBI⁵ and work regarding the Ohio State University Traumatic Brain Injury-Identification (method TBI-ID).⁶ In step 1 of the long form of the Ohio State University TBI-ID, the administrator is instructed to help the person recall injuries during their lifetime that may have included a TBI.⁷ A series of questions is then used to facilitate this (eg, From any time in your life, are there any injuries you may have forgotten to mention? Think about times you might have been in a car accident, crashed a bike, fell, got hurt playing sports, or somebody hit you or shook you hard, or you were exposed to an explosion or blast).⁷ As such, the TBI-4 is composed of 4 questions; 1 question specifically queries about loss of consciousness secondary to an accident or injury, which is a clear indicator of probable TBI (question 2). The other 3 questions query regarding risky situations/behaviors that are frequently associated with sustaining a TBI (questions 1, 3, 4).⁸ TBI-4 questions are as follows: (1) Have you ever been hospitalized or treated in an emergency department after a head or neck injury?; (2) Have you ever been knocked out or unconscious after an accident or injury?; (3) Have you ever injured your head or neck in a car accident or in some other moving vehicle collision?; and (4) Have you ever injured your head or neck in a fight or fall?

To establish the sensitivity and specificity of the TBI-4, Brenner⁴ compared screening responses to findings from the Ohio State University TBI-ID, a criterion standard structured clinical interview for identifying lifetime history of TBI.⁶ When a positive response to question 2 was used as the criterion for a positive screen, sensitivity was 58% and specificity was 77%. Using a positive response to any question on the screener as the criterion for a positive screen, the sensitivity and specificity were 74% and 56%, respectively. Based on the limited risk associated with false positive identification, findings supported implementation of the 4-question screen in VHA mental health settings.⁴

Examination of predictive validity is another means of providing psychometric support for a screening tool. Specifically, this entails determining if the screening tool is predictive of outcomes often associated with the phenomena being screened.⁶ In TBI, postinjury health care utilization, including mental health, is a frequently discussed outcome of interest.⁹⁻¹²

Homaifar et al¹¹ conducted a study in this area and capitalized on the availability of rehabilitation medicine professionals to aid in the confirmation of TBI diagnosis. The findings suggested that use of primary care/internal medicine, rehabilitation, psychiatry/substance use, and other services (eg, ancillary, diagnostic, prosthetic, dental, nursing home, home care) remained constant for veterans with TBI who were between 4 and 40 years postinjury.¹¹ This pattern changed at 40 years postinjury, wherein veterans with TBI used more psychiatry/substance abuse services than primary care, rehabilitation, or other services. This finding is consistent with civilian literature, which suggests that the use of mental health care services outpaces that of other health care service use for those in the postacute stage of TBI.^{9,10}

In a more recent study using the VHA National Patient Care Database, Drag et al¹² examined the impact of demographic/clinical factors and comorbid psychiatric diagnoses on both inpatient and outpatient health care utilization among all veterans seeking health care services at the Veterans Affairs Palo Alto Healthcare System between 2000 and 2012. A history of TBI was identified via presence or absence of *International Classification of Diseases, 9th Revision* diagnoses in electronic medical records. Compared with those with no TBI, veterans with TBI were 2.5 times more likely ($P < .001$) to be psychiatrically hospitalized and also had a significantly greater number of psychiatric hospitalizations ($P < .001$).¹² Veterans with TBI also had a significantly greater number of outpatient mental health visits ($P < .001$) than their counterparts.¹²

As previously noted, the TBI-4 was developed, in part, to address the need for improved methods of screening for lifetime TBI among veterans of all cohorts in mental health settings. We explored the use of 2 criteria to determine an individual's TBI status in this sample: criterion 1 was a positive response to any TBI-4 question ($n = 942$ positive, $n = 551$ negative), and criterion 2 was a positive response to question number 2 ($n = 657$ positive, $n = 836$ negative). With predictive validity being a means of providing psychometric support for a screening tool, hypotheses were tested using criteria 1 and 2 as follows. In the year after administration of the TBI-4, those who answered positively compared with those who answered negatively would have significantly greater odds of having a psychiatric hospitalization, higher numbers of psychiatric hospital stays, greater odds of having an outpatient mental health contact, and higher numbers of outpatient mental health contacts.

Methods

Procedures

This is an analysis of secondary aims from a study funded by the Colorado Traumatic Brain Injury Trust Fund. Data from primary aims have been published, and descriptions of the larger study sample from which the current sample was derived can be found in Brenner.⁴ Institutional review board permission was obtained prior to initiation of any data collection.

The current study sample consisted of 1494 veterans receiving outpatient mental health services from a mountain state Veterans Affairs medical center who were given the TBI-4 during a mental health intake between December 2006 and February 2010. Veterans' medical and demographic records were obtained from the Corporate Data Warehouse, which contains clinical and administrative archival data. One year of data was collected for each participant after the date of their TBI-4 screening. Records for 1 veteran could not be found in these databases; therefore, the

List of abbreviations:

TBI	traumatic brain injury
TBI-ID	Traumatic Brain Injury-Identification
TBI-4	Traumatic Brain Injury-4
VHA	Veterans Health Administration

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