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The Relationship Between Future Self-Continuity and Suicide Risk in Military Veterans with Traumatic Brain Injury

RESEARCH

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ABSTRACT

Veterans with Traumatic Brain Injury (TBI) have an increased risk for suicide. A lack of Future-Self Continuity (FSC), which refers to the sense of "psychological connectedness" that a person has between their present and future selves, has also been associated with suicide risk. For this study 309 US military veterans, 39 of whom self-reported a TBI, completed a series of questionnaires to assess FSC and suicidality. The results replicated previous findings that TBI and low FSC were individually associated with increased suicidality. Additionally, FSC was found to have a moderating effect on TBI, in that TBI was associated with increased suicide risk only when FSC was low or moderate. When FSC was high, TBI was not associated with increased suicide risk. Examination of the three subcomponents of FSC revealed that FSC-Vividness and FSC-Positivity moderated the TBI-suicidality relationship, while FSC-Similarity had no significant moderating effect. These results suggest that high FSC may be a protective factor for suicide risk among veterans with a TBI diagnosis. Understanding this relationship between TBI, FSC, and suicidality could help enhance suicide prevention efforts.

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While representing only 8.0% of the adult US population, veterans account for approximately 13.7% of suicide deaths each year (Office of Mental Health and Suicide Prevention, 2021). Within the veteran population, those with Traumatic Brain Injury (TBI) are at increased risk for suicide, with veterans suffering from a TBI twice as likely to report suicidal ideation (Swanson et al., 2017; Shura et al., 2019).

TBI, defined as "traumatically induced structural injury of the brain resulting from external force" (Swanson et al., 2017, p.1), emerged as a critical area of research following the Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) wars due to a substantial increase in head and neck injuries. Although the prevalence of TBI has been difficult to establish, conservative estimates place TBI prevalence at 20% for OEF/OIF veterans (Swanson et al., 2017).

Mild TBI, or concussion, which is the least severe form of TBI, remains the most difficult to diagnose due to a lack of physical or observable wounds. Physical symptoms of mild TBI include fatigue, headache, blurred vision, and tinnitus. Psychological symptoms include mood changes, and cognitive symptoms include confusion and memory difficulties. Moderate or severe TBI include symptoms such as nausea, persistent headaches, and seizures (Bagalman, 2013). Severe TBI increases the risk of developing abnormal executive functioning skills, adverse social behaviors, increased aggression, and may result in comatose and vegetative states (Swanson et al., 2017). Among OEF/OIF veterans with TBI, cognitive deficits such as slowed processing, attention, and memory difficulties are all associated with higher rates of suicidal ideation (Crocker et al., 2018).

When examining cognitive difficulties and functional impairments during the rehabilitation process for TBI, the impact of TBI on self-identity is often overlooked (Ownsworth & Haslam, 2014). Predominantly, TBI is associated with negative changes in self-identity, which is defined as a person's understanding of their inner qualities, potential, and consistency over time. Negative changes in self-identity among individuals with mild TBI has been found to persist 3 years post-TBI (Ownsworth & Haslam, 2014). A similar pattern was observed in a study of 25 young adults recovering from more severe TBIs where 18 had been unconscious for more than 24 hours and 19 had a period of posttraumatic amnesia exceeding one week. Throughout 7 months of post-injury observation, 72% of subjects perceived their present selves as more "dependent, frustrated, and irritable, and of less worth" (Tyerman & Humphrey, 1984, p. 4) than their pre-injury selves (Ownsworth & Haslam, 2014).

A systematic review of the literature examining the relationship between TBI and self-identity by Beadle et al. (2016) concluded that negative changes in self-identity were related to the broader experience of a traumatic event and subsequent adjustment to injury or loss, as opposed to neurological damage. In support of this conclusion, no differences in personality characteristics were found between individuals with mild TBI compared to moderate or severe TBI (Beadle et al., 2016).

Previous studies on self-identity have focused on changes in self-perception between the past self and present self, however the relationship between TBI and self-identity can also be explored in connection to the future self. This assessment of the relationship between the present and future self is known as future self-continuity (FSC) and refers to the sense of psychological connectedness that a person has with their future self and the extent to which a person is able to sense consistency between their future self and present self (Bartels & Urminsky, 2011; Sokol & Serper, 2019).

Previous studies have found that people with higher levels of FSC have improved decision making and lower levels of depression, anxiety, stress, hopelessness, and suicidality (Hershfield, 2011; Lester, 2013; Sokol & Eisenheim, 2016; Sokol & Serper, 2019a; 2019b). Conversely, lower levels of FSC have been found to be related to increased mood disturbances, risky life choices, suicide risk, hopelessness, and sacrifice of future self-interests (Hershfield, 2011; Sokol & Eisenheim, 2016; Sokol & Serper, 2019). Furthermore, in a study of hospitalized adolescent psychiatric patients, 82% of those at high risk for suicide reported no sense of self-continuity, an identity construct which is conceptualized as connection from past to present self as well as present to future self, whereas all members of the non-patient control group reported at least some sense of self-continuity (Ball & Chandler, 1989).

Although previous studies have examined the relationship between FSC and suicidality, FSC in relation to both TBI and suicidality remains an unexplored area. Although unexplored, tangential research gives pause for the consideration of a significant relationship. One study found that levels of FSC are predicted by levels of episodic memory and use of heuristics (Sokol et al., 2017). This was interpreted to mean that developing FSC requires recalling and processing personal life events (Sokol et al., 2017). It is therefore possible that the cognitive difficulties associated with TBI may play an important role in individuals with lowered FSC and/or increased suicidality.

Additionally, there is some evidence that the subcomponents of FSC may have distinct relationships with psychopathology and may therefore bear relevance to TBI symptomatology. The three theorized subcomponents are Similarities to the Future Self (FSC-Similarity), Vividness of the Future Self (FSC-Vividness), and Positive Affect towards the Future Self (FSC-Positivity; Hershfield, 2011; Parfit, 1984; Sokol & Serper, 2019). A previous study found a negative correlation between FSC-Similarity and stress/anxiety, as well as a negative correlation between FSC-Positivity and depression/suicidality (Sokol & Serper, 2019). Sokol and Serper (2019) theorized that the differences among the

subcomponents' relationships with various psychological outcomes are related to an individual's interpretation of their life events. For example, a stronger sense of FSC-Positivity may decrease the likelihood an individual will feel low self-worth or be overwhelmed by negative life events, both of which are influences on depression (Sokol & Serper, 2019).

Due to lack of current research on the relationship between future self-continuity, suicidality, and TBI, the impacts of the individual FSC subcomponents on TBI psychopathology remains unclear. Investigating each subcomponents' relationship with TBI may lead to a deeper understanding of how the presence of a TBI may influence psychopathology and suicidal behavior.

The current study sought to answer the following questions: Does FSC as a whole affect the relationship between suicidality and TBI? If so, are there individual interactions between the FSC subcomponents, suicide risk, and TBI?

As TBI diagnosis has been found to be predictive of increased suicide risk, and FSC has been found to be protective against suicide risk, we hypothesize that FSC will moderate the relationship between TBI and suicidality in veterans and ultimately serve as a protective mechanism against suicidality (Crocker et al., 2018; Sokol et al., 2021). Due to the inverse relationship between the FSC subcomponents and reported psychopathology, we hypothesize that each subcomponent (similarity, vividness, and positivity) will serve as separate and significant moderators between the presence of TBI and suicide risk (Sokol & Serper, 2019).

METHOD

PARTICIPANTS

Study approval was obtained by the Teacher's College Columbia University Institutional Review Board (reference #21-091). Three hundred nine adult veterans were recruited via online survey after providing informed consent. Inclusion criteria for participation in the surveys included English-proficient US military veterans over the age of 18. Thirty-nine of the 309 veterans self-reported suffering from a TBI. Participants ranged between the ages of 24 and 83 years with a mean age of 46.2 (*SD* = 13.9). Eighty-seven-point-one percent of participants identified as Caucasian, 9.4% as Hispanic or Latino, 3.6% as African American, 2.3% as Asian or Pacific Islander, and 1.3% as Native American or American Indian. Of the 309 participants that completed the surveys, 39 (12.6%) endorsed suffering a TBI during military service. Of the 221 respondents (72%) that were enlisted, 144 (65%) reported a rank at discharge of E5 or above. Of the 81 (26%) respondents that were officers, 38 (47%) reported a rank at discharge of O4 or above. Regarding deployment and combat experiences, 203 (66%) reported at least one deployment (*M* = 2.36, *SD* = 6.15). All individuals reporting experience of a TBI also reported having served in combat. The range of years served was 42 years (*M* = 12.24, *SD* = 9.05), and the range of years since discharge was 55 (*M* = 14.23, *SD* = 14.33). For additional sample demographic information, see Table 1.

CHARACTERISTICS	RANGE	MEANS (SD) OR % (*N*)
Age	24–83	46.2 (13.9)
Gender (% female)	—	18.4% (57)
Race/ethnicity	—	
Caucasian		87.1% (269)
African American		3.6% (11)
Hispanic or Latino		9.4% (29)
Native American or American Indian		1.3% (4)
Asian/Pacific Islanders		2.3% (7)
Sexual Orientation	—	
Straight		95.8% (296)
Gay or Lesbian		1.6% (5)
Bisexual		1.6% (5)
Other		1% (3)
Marital status	—	
Single - never married		12% (37)
Married or domestic partnership		72.8% (225)
Widowed		1.3% (4)
Single-Divorced		12.3% (38)
Separated		1.6% (5)
Education Level	—	
High School		6.5% (20)
Some college, no degree		19% (59)
Associate degree		11% (34)
Bachelor's degree		29% (91)
Master's degree		30% (94)
Doctoral degree		3% (8)
Professional degree (MD, JD)		1% (3)
Most recent branch of service	—	
Army		44.3% (137)
Marines		14.9% (46)
Navy		21.7% (67)
Air Force		15.5% (48)
Coast Guard		2.6% (8)
National Guard		1% (3)
Employment Status	—	
Currently employed		74% (228)
Retired		26.6% (82)
Unemployed		5.5% (17)
Homemaker		2.3% (7)
Student		17.5% (54)
Unable to work due to disability		8.1% (25)

Table 1 Sample Demographic Information (*N* = 309).

PROCEDURES

Participants were recruited using professional networks, social media advertisements, veteran community and outreach groups, and word of mouth. Social media sites used for recruitment include LinkedIn, Facebook, Reddit, and Twitter. Professional networks included VETS2INDUSTRY, Shift.org, Heroic Hearts, Maximum Consulting, VetToCEO, Project Transition USA, Veterans One-Stop of WNY, University of Alabama, and CVS, in addition to other large-scale industry social organizations.

The online survey was presented as distinct chapters. Each chapter addressed different aspects of the experience of transitioning out of the military. For the first survey chapter, consenting participants filled out an eight-to-10-minute survey of basic demographic information (i.e., ethnicity, age, gender, marital status, employment status, education, and military experiences). Participants were asked a global question regarding previous traumatic brain injury assessment: "As far as you know, did you suffer a traumatic brain injury (TBI) during your military service?" Severity of the TBI, if a participant endorsed receiving one, and lifetime diagnosis of TBI outside of military service, were not assessed. Following completion of the first survey chapter, participants were asked to complete a second chapter, which addressed their current mental health and included the Suicide Behavior Questionnaire (SBQ-R) and the Future Self-Continuity Questionnaire (FSC-Q).

Data was collected entirely online. Qualtrics survey management software was used to administer the survey questionnaires and to store the survey data. Data collection for this study began on January 12, 2021, and continued through May 30, 2021.

MEASURES

Future Self-Continuity Questionnaire

The Future Self-Continuity Questionnaire (FSCQ; Sokol & Serper, 2019) assesses an individual's temporal sense of personal identity from the present to the future. This Likert scale questionnaire (responses between 0–6) is a 10-item self-report instrument that addresses three areas of future self-continuity: vividness, similarity, and positivity. Examples of items in the FSCQ include, "How similar are you now to what you will be like 10 years from now?" and "How vividly can you imagine what you will be like 10 years from now?" A total FSCQ score is averaged from all of the FSCQ items. Subcomponent scores are averaged from the responses to items in each subscale. Higher scores indicate increased future self-continuity. For the FSCQ, Cronbach's alpha was calculated for the similarity to future self-subcomponent, which consisted of 4 items (α = .87), the vividness of future self-subcomponent, which consisted of 3 items (α = .82), and the overall positive affect to future self-subcomponent, which consisted of 3 items (α = .9). Both the total FSCQ and the FSCQ subcomponents have been found to have test-retest reliability and construct validity (Sokol & Serper, 2019).

Suicide Behaviors Questionnaire-Revised

The Suicide Behaviors Questionnaire-Revised (SBQ-R; Osman et al., 2001) was used to measure participants' suicidality, i.e., their level of suicidal ideations and behaviors. This four-item questionnaire addresses specific suicidal factors, including the presence and frequency of suicidal thoughts, the threat of past suicidal attempts, and the likelihood of future suicidal attempts. The SBQ-R total scores have been found to have test-retest reliability as a clinical and non-clinical measure of suicidality (Osman et al., 2001). For the SBQ-R, Cronbach's alpha was calculated for the 4 items (α = .81).

RESULTS

Pearson correlations were computed between suicidality, TBI, and FSC (see Table 2 for correlation matrix and M/SDs). As in previous studies, a statistically significant positive correlation was found between suicidality and TBI, r (309) = .21 $p < .001$, indicating that TBI is directly correlated

MEASURE	1	2	3	3.1	3.2	3.3	M	SD
1. TBI	—	.21*	–.05	–.05	–.01	–.05	—	—
2. SBQ-R		—	–.3*	–.11	–.25	–.33*	5.8	3.02
3. FSCQ			—	.7*	.77*	.7*	3.86	.82
3.1 Similarity Subscale of FSCQ				—	.24	.11	3.75	1.14
3.2 Vividness Subscale of FSCQ					—	.54*	3.54	1.12
3.3 Positivity Subscale of FSCQ						—	4.34	1.15

Table 2 Future Self-Continuity and Suicidality Variables for non-TBI (n = 269) and TBI groups (n = 39).

* Correlation is significant at the 0.01 level (2-tailed).

with increased suicidality. Also as expected, suicidality and future self-continuity (FSCQ) also displayed a significant negative correlation, r (309) = –.30, p < .001, indicating that lower future self-continuity is related to increased suicidality (See Table 2).

To test the hypothesis that FSC moderates the relationship between suicidality and TBI, a hierarchical multiple regression analysis was conducted. In the first step of the regression analysis, FSC and TBI were found to account for a significant proportion in the variance of suicide among veterans, R^2 = .158, F = 19.02, p < .001. To avoid potentially problematic high multicollinearity with the interaction term, the variables were centered and an interaction term between transition stress and future self-continuity was created (Aiken et al., 1991). In the second step of the regression analysis, the interaction term between FSC and TBI was added to the regression model, which accounted for a significant additional proportion of the variance in suicidality, ΔR^2 = .03, ΔF = 10.87, p < .001, b = –1.77, t = –3.30, p < .001. Thus, the overall model showed that future self-continuity was a significant moderator of the relationship between suicidality and TBI.

The regression model was assessed at three different levels to assess the relationship between the variables, TBI and suicide, at varying levels of future self-continuity. Levels of FSC were measured via the FSCQ using a standard method for interpreting continuous variable interactions: creating three points – 1*SD* above the mean, the mean and 1 *SD* below the mean (representing low, medium, and high levels of future self-continuity, respectively). The results indicated (see Figure 1) at low (p < .001) and moderate (p = .002) levels of future self-continuity there was a significant relationship between TBI and suicide. However, when FSC was high (p = .913), having a TBI did not lead to increased suicide risk. Thus, TBI appears to only lead to increased suicide risk when future self-continuity is low or moderate but not high.

Upon finding that the overall model was significant, a series of analyses identical to the above with FSC were conducted to evaluate the potential moderating effect between each individual subcomponents of FSC (FSC-Similarity, FSC-Vividness, and FSC-Positivity) and TBI. FSC-Similarity was not a significant moderator between the presence of TBI and suicidality (p = .996). However, both FSC-Vividness (effect = 2.97, *SE* = .637, 95% *CI* = 1.71; 4.22, r (309) = –.01, p < .001) and FSC-Positivity (effect = 3.24, *SE* = .584, 95% *CI* = 2.09; 4.40, r (309) = –.05, p < .001) were significant moderators of the relationship between TBI and suicidality.

DISCUSSION

In line with previous research, our results indicated that both veterans reporting a TBI and veterans with lower FSC reported increased suicidality. Furthermore, FSC was found to be a significant moderator in the relationship between TBI and suicidality. Previous findings have demonstrated that

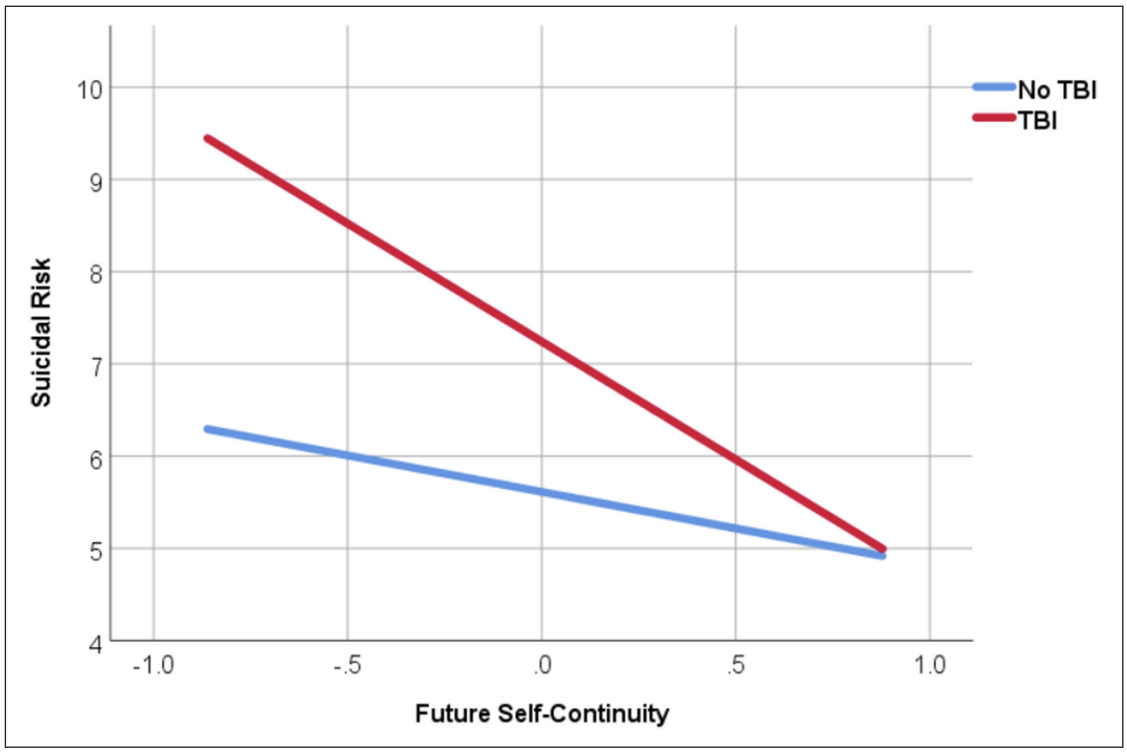

Figure 1 Presence and Absence of TBI Mediates Future Self-Continuity's Association with Suicidal Risk.

high FSC is associated with greater likelihood to mitigate suicide risk and improve self-care (Ersner-Hershfield et al., 2009; Hershfield, 2011). This relationship was confirmed in the current study, where higher levels of future self-continuity appeared to buffer the effects of TBI on suicidality. Follow-up analyses showed that the presence of TBI was only associated with increased suicidality when FSC was low or moderate, but when FSC was high, the presence of TBI was no longer significantly associated with increased suicidality. This suggests that the strength and clarity of one's conceptualization of their FSC is crucial to understanding the relationship between TBI and increased suicidality. As previous research has stated, TBI is more commonly associated with negative, rather than positive, changes in self-conceptualization (Beadle et al., 2016). Suffering a TBI can lead to a loss of self and difficulty envisioning a meaningful future (Ownsworth & Haslam, 2014). However, results within our sample, though limited, indicate that individuals with high future self-continuity, even with self-reported experience of TBI diagnosis, do not experience an increase in suicidality.

Examination of the subcomponents of the FSC scale yielded meaningful information about the mechanisms of FSC among veterans diagnosed with TBI. While both the vividness and positivity subcomponents, which are associated with a veteran's imagery of their future selves (FSC-Vividness and FSC-Positivity) were found to be significant moderators between TBI and suicidality, the subcomponent looking at similarity between present and future self (FSC-Similarity) in this sample was not found to be a significant moderator. A possible explanation for the lack of connection between the similarity subcomponent and the relationship between TBI and suicidality might be related to the negative downstream effects of TBI. Previous research has highlighted the adverse impact TBI has on physical, cognitive, and emotional functioning (Swanson et al., 2017). It can fundamentally alter an individual's path in life and affect their sense of who they are and might become (Evans, 2011; Ownsworth, 2014). Due to this influence, it may be that feeling similar to a disrupted future self does not serve as a protective factor against suicidality.

The present study includes significant limitations that warrant future studies exploring this area. One consideration is the sample population of this study: adequate cognitive and comprehension skills were a prerequisite for completing the survey, which may have excluded veterans with moderate or severe TBI from the sample pool. Furthermore, participants were recruited through social networking platforms and peer-to-peer snowball methods, focused primarily on the professional, vocationally focused online platform LinkedIn. Seventy-four percent of the current study's participants reported being employed. As previous research has found that employed veterans with TBI report less severe symptoms (Cotner et al., 2018), this suggests that our sample is skewed towards the less severe end of the TBI spectrum. For these reasons, it is likely that those with more severe TBI injuries are not represented in this study, and the study results may not generalize to those with more severe TBI symptomatology.

Another consideration is the small sample size of self-reported TBI instances among our survey participants. Due to our sample size, these results should be considered an indication that deeper investigation is warranted to further understand this relationship. Our sample also included veterans from conflict eras prior to OIF/OEF. As blast injury has become the most common wound from the OIF/OEF era, veterans from prior wars could have possibly experienced different types of head injuries. Additionally, TBI was assessed through self-report, not with standardized diagnostic measures; it is not certain that individuals who see themselves as having a TBI would meet diagnostic criteria for a TBI. Due to these limitations, the current study's findings should be viewed as preliminary. It is critical for the findings to be replicated in a more controlled clinical sample before assuming these findings would extrapolate to the general TBI veteran population.

The study's findings lead to several important considerations for future research directions. First, subsequent investigations should assess the severity of TBI and recruit veterans with varying clinical presentations, severity of TBI, and suicidality. This would enable researchers to better understand FSC's protective effect on suicidality as well as how TBI may influence the cognitive capacity to maintain FSC. Additionally, it would be useful to confirm these relationships using a longitudinal prospective study with a clinical population. Replicating this study with a larger sample of military veterans with TBI would also help strengthen the findings discovered here. It would be important for future studies to utilize additional assessment methods to better understand the impact of TBI on cognitive function (e.g., deficits in executive functioning, working memory, etc.), as this may further clarify the relationship between TBI, FSC, and suicidality. Finally, as TBI has been deemed the "signature wound" of OIF/OEF combat veterans, future studies should also consider looking at the influence of combat exposure and posttraumatic stress disorder as additional components to expand and further understand ways that FSC interacts with TBI and suicidality. Should this study's results be replicated and validated through the above suggested research there may be significant clinical implications including developing focused FSC psychotherapeutic techniques. Multiple studies have shown that FSC can be increased using psychotherapeutic techniques (Sokol & Serper, 2019; Sokol et al, 2021; Van Gelder et al., 2013). Therefore, it is possible that downstream effects of TBI

(such as on suicidality) might be ameliorated with focused FSC psychotherapeutic interventions.

CONCLUSION

To our knowledge the current study was the first to assess the relationship between FSC, TBI, and suicidal ideation. As research with other populations has found, the degree of the lack of psychological connectedness a person has with their future self relates to the severity of mental health and behavioral challenges, such as suicidal behavior. With more than 20% of returning post-9/11 combat veterans reporting head and neck injuries, including TBI, it seems likely that providers working with these veterans would benefit from awareness of the influence of FSC, which could play a role in targeting treatment and further reducing the rate of suicidality among our nation's heroes. The current study suggested that veterans diagnosed with TBI and who reported high FSC were significantly less likely to report suicidal ideation than those reporting lower levels of FSC. This provides a possible avenue for further understanding risk of suicidality among veterans with TBI. Incorporating this marker into cognitive and mental health interventions, education, and relevant public policy could improve efforts in the identification and provision of support for veterans with TBI. Greater insight into the relevant constructs and intricacies of FSC and how it may play into the needs of veterans with TBI can inform the development and implementation of effective rehabilitation treatments.

ETHICS AND CONSENT

Study approval was obtained by the Teacher's College Columbia University IRB (reference #21-091).

COMPETING INTERESTS

The authors have no competing interests to declare.

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