



Invited Commentary | Psychiatry

# Detangling the Association Between Traumatic Brain Injury, Mental Health, and Suicide in Active Duty Service Members

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Suicide in the military represents a significant and multifaceted problem, with complex and interdependent factors contributing to its occurrence. Disentangling the intricate temporal associations between suicide and its numerous risk factors poses a significant challenge. Of the purported risk factors, traumatic brain injury (TBI) has received special focus, given its unfortunate status as the signature injury in active duty service members who served in Operation Enduring Freedom and Operation Iraqi Freedom. The complex interplay between TBI, its potential effects on mental health, and risk of suicide remains a vexing focus of ongoing investigations and academic inquiry.

In this study, Brenner and colleagues<sup>1</sup> present a retrospective cohort analysis of active duty service members in the Department of Defense Substance Use and Psychological Injury Combat Study. This large study includes more than 860 000 active duty service members returning from deployment in Afghanistan or Iraq and is bolstered by uniform access to participant records. Of note, 12.6% of the cohort had documentation of at least 1 TBI, but this likely represents an underestimate, given diagnostic difficulty associated with this injury and limits of electronic medical record review.<sup>1</sup> Brenner et al<sup>1</sup> compared the onset of new behavioral health conditions over time between a matched sample of active duty service members with and without documented, military-identified TBI. Although the cohort was mostly younger men, the striking findings include marked increases in mental health diagnoses, most notably mood (increased 67.7% in active duty service members with TBI vs 37.5% in those without) and substance use disorders (increased 100% in active duty service members with TBI vs 14.5% in those without). Brenner et al<sup>1</sup> found that time to suicide was markedly faster among active duty service members with history of TBI compared with those without a history of TBI (21.3% faster; estimate, 0.787; 95% CI, 0.715-0.866), especially among individuals with new-onset substance use disorder (62.8% faster; estimate, 0.372; 95% CI, 0.322-0.433). This study underscores the burden of suicide and multidimensionality of suicide risk among military personnel and veterans.

The findings of this study are bolstered by its large numbers and uniform access to participant records. The data presented build on prior work suggesting that TBI may be facilitatory or causative of chronic disease. Findings from the National Institute on Disability, Independent Living, and Rehabilitation Research TBI Model System (NIDILRR TBIMS) reported a 9-year shorter life span<sup>2</sup> and elevated behavioral health issues after moderate to severe TBI.<sup>3</sup> Indeed, in another TBIMS study, Fisher and colleagues<sup>4</sup> noted that individuals with TBI are at greater risk for depression and suicidal behavior many years after TBI.<sup>4</sup> In a different civilian cohort of more than 9000 persons with TBI and controls, Izzy and colleagues<sup>5</sup> demonstrated an enhanced odds ratio of psychiatric and general health disorders, including depression, anxiety, psychosis, and suicidal ideation, following TBI.<sup>5</sup> Of interest, the study by Izzy et al<sup>5</sup> demonstrated striking time-to-event links to psychiatric comorbidities, with the mild TBI cohort developing depression, anxiety, and alcohol use disorder significantly sooner than those without history of TBI. Together with the work of Brenner and colleagues,<sup>1</sup> these studies suggest that an at-risk maladaptive phenotype exists and requires early identification. In addition, a study by Wilder and colleagues<sup>6</sup> used a patient claims data set of more than 11 000 participants and noted that 48% were later diagnosed with a mental illness within 3 years following their concussion.<sup>6</sup> Although neither Brenner and colleagues<sup>1</sup> nor Wilder and

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colleagues<sup>6</sup> corrected for visit frequency bias, Izzy and colleagues<sup>5</sup> did so and suggested that the behavioral health risk associated with TBI was not related to encounter bias. Using the Transforming Research and Clinical Knowledge in TBI (TRACK-TBI) data set, Stein and colleagues<sup>7</sup> noted high rates of posttraumatic stress disorder (PTSD) and depression at 6-month follow-ups among individuals who presented to the emergency department with mild TBI.<sup>7</sup> Critically, using the Injury and Traumatic Stress network, Fisher and colleagues<sup>8</sup> noted that PTSD seems to be driving risk for suicidal behavior among individuals with mild TBI. Thus, these interaction terms warrant further examination. Using the same TRACK-TBI study, Nelson and colleagues<sup>9</sup> noted marked functional limitations among more than 50% of individuals with mild TBI compared with orthopedic trauma controls at 1 year after injury, suggesting that maladaptation is common after mild TBI.

Substance use has been linked to TBI for decades and has been an underresourced area of post-TBI research. In this work, Brenner and colleagues<sup>1</sup> identified substance use disorder as a key factor in faster time to suicide for active duty service members with a history of TBI compared with those without TBI and theorized that a multiple stress or exposure burden may enhance risk. This theory is reasonable and has been postulated among individuals with medical sequelae linked to TBI. Thus, issues such as stress, adverse childhood experiences, and numerous medical and psychiatric premorbid and postmorbid health concerns may well play a role. While this work is critical in the military population, caution should be given to avoid direct generalization to other populations, such as athletes, for whom the linkage to suicidal ideation is less understood.

Although this work by Brenner and colleagues<sup>1</sup> is limited by the retrospective nature of this cohort, the dislinkage to clinical intervention data, and the possibility that a pre-TBI phenotype and issues, such as pain, played a selection role in the group with post-TBI new-onset mental health conditions, these findings, in concert with those of others, compel us to examine this issue further, using sophisticated methodological strategies. Taken together, this work suggests a need to further longitudinally examine the biopsychosocial risks of TBI, especially among individuals serving in the military, so that early interventions can be developed for those on a more deleterious path.

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## ARTICLE INFORMATION

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## REFERENCES

1. Brenner LA, Forster JE, Gradus JL, et al. Associations of military-related traumatic brain injury with new-onset mental health conditions and suicide risk. *JAMA Netw Open*. 2023;6(7):e2326296. doi:[10.1001/jamanetworkopen.2023.26296](https://doi.org/10.1001/jamanetworkopen.2023.26296)
2. Harrison-Felix C, Kolakowsky-Hayner SA, Hammond FM, et al. Mortality after surviving traumatic brain injury: risks based on age groups. *J Head Trauma Rehabil*. 2012;27(6):E45-E56. doi:[10.1097/HTR.0b013e31827340ba](https://doi.org/10.1097/HTR.0b013e31827340ba)
3. Dams-O'Connor K, Juengst SB, Bogner J, et al. Traumatic brain injury as a chronic disease: insights from the United States Traumatic Brain Injury Model Systems Research Program. *Lancet Neurol*. 2023;22(6):517-528. doi:[10.1016/S1474-4422\(23\)00065-0](https://doi.org/10.1016/S1474-4422(23)00065-0)

4. Fisher LB, Pedrelli P, Iverson GL, et al. Prevalence of suicidal behaviour following traumatic brain injury: Longitudinal follow-up data from the NIDRR Traumatic Brain Injury Model Systems. *Brain Inj*. 2016;30(11):1311-1318. doi:[10.1080/02699052.2016.1195517](https://doi.org/10.1080/02699052.2016.1195517)
5. Izzy S, Chen PM, Tahir Z, et al. Association of traumatic brain injury with the risk of developing chronic cardiovascular, endocrine, neurological, and psychiatric disorders. *JAMA Netw Open*. 2022;5(4):e229478. doi:[10.1001/jamanetworkopen.2022.9478](https://doi.org/10.1001/jamanetworkopen.2022.9478)
6. Wilder JH, Gupta SS, Kelly GC, et al. Examining the relationship between mild traumatic brain injuries and development of mental illness disorders in a mid-term follow-up period. *Am J Phys Med Rehabil*. 2022;101(12):1117-1121. doi:[10.1097/PHM.0000000000001985](https://doi.org/10.1097/PHM.0000000000001985)
7. Stein MB, Jain S, Giacino JT, et al; TRACK-TBI Investigators. Risk of posttraumatic stress disorder and major depression in civilian patients after mild traumatic brain injury: a TRACK-TBI study. *JAMA Psychiatry*. 2019;76(3):249-258. doi:[10.1001/jamapsychiatry.2018.4288](https://doi.org/10.1001/jamapsychiatry.2018.4288)
8. Fisher LB, Bomyea J, Thomas G, et al. Contributions of posttraumatic stress disorder (PTSD) and mild TBI (mTBI) history to suicidality in the INTRUST consortium. *Brain Inj*. 2020;34(10):1339-1349. doi:[10.1080/02699052.2020.1807054](https://doi.org/10.1080/02699052.2020.1807054)
9. Nelson LD, Temkin NR, Dikmen S, et al; the TRACK-TBI Investigators. Recovery after mild traumatic brain injury in patients presenting to US level I trauma centers: a Transforming Research and Clinical Knowledge in Traumatic Brain Injury (TRACK-TBI) Study. *JAMA Neurol*. 2019;76(9):1049-1059. doi:[10.1001/jamaneurol.2019.1313](https://doi.org/10.1001/jamaneurol.2019.1313)