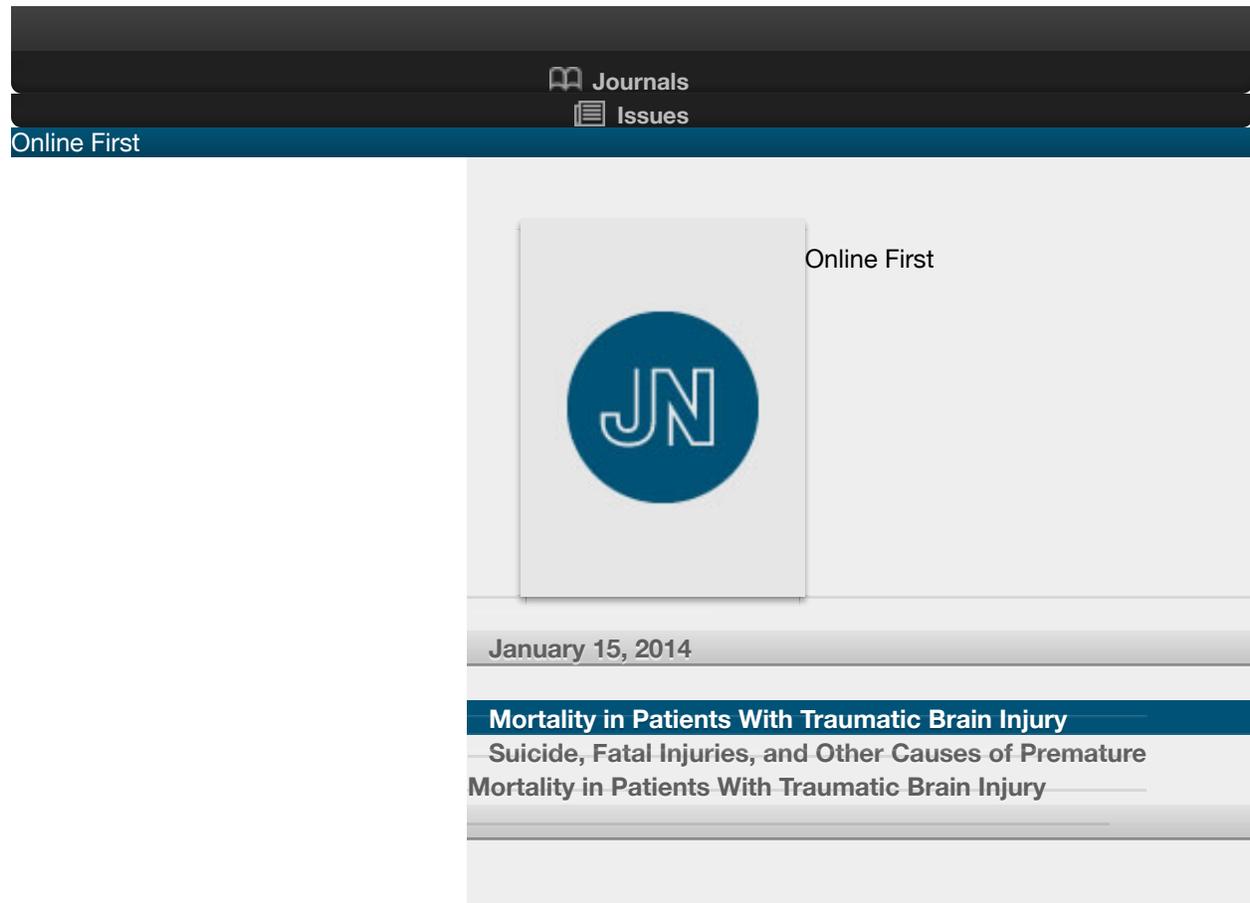


# Mortality in Patients With Traumatic Brain Injury



EDITORIAL

## Mortality in Patients With Traumatic Brain Injury

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The current issue of *JAMA Psychiatry* includes an important article on premature mortality among patients with traumatic brain injury (TBI) in Sweden between 1969 and 2009. <sup>1</sup> According to the study by Fazel et al, <sup>1</sup> among 218300 patients with a TBI compared with age- and sex-matched controls without brain injury (10 to 1 match, n=2163190) and unaffected siblings of TBI patients (n=150513), there was a 3-fold increased odds of all-cause mortality, adjusted for sociodemographic confounders (adjusted odds ratio [aOR], 3.2; 95% CI, 3.0-3.4), among patients who survived at least 6 months after TBI compared with general population controls or unaffected siblings (aOR, 2.6; 95% CI, 2.3-2.8). The increased rates of mortality were related to injury (aOR, 4.3; 95% CI, 3.8-4.8), assault (aOR, 3.9; 95% CI, 2.7-5.7), or suicide (aOR, 3.3; 95% CI, 2.9-3.7).

A major strength of this study, which used national Swedish patient registry data, was the statistical power derived from the large database. This database allowed the authors to examine, in detail, causes of early mortality when the overall frequency of premature mortality was relatively small. Among the 218 300 patients with TBI, premature death, which occurred after 6

months following the TBI and before 56 years of age, constituted only 2378 (1.1%) of the TBI cases. Furthermore, the causes of mortality, which include multiple physical illnesses and external causes, such as motor vehicle collisions, other injuries, suicide, and assault, were compared with controls and examined in detail. Consequently, this study had the power to compare death rates in a small portion of the population. External causes of mortality constituted almost half (48.6%) of the premature deaths compared with physical disorders, such as neoplasms, which caused premature death in 11.1% of the 2378 cases.

Traumatic brain injury has become a topic of public interest in the United States within the past 10 years because of the common causes of brain injury, such as combat, sports (particularly football), and unprovoked assaults. These potentially preventable injuries have attracted the attention of the military leadership, the families of injured people, politicians, sports organizations (particularly the National Football League), psychiatrists, psychologists, attorneys, and others. The pathologic features, symptoms, and course of TBI can be widely different depending on the cause, type (eg, contusion, shear, and intracranial bleed), or severity of the injury. Many of the US soldiers from the Iraq and Afghanistan wars experienced TBI from shock waves generated by improvised explosive devices, <sup>2</sup> whereas others incurred

penetrating brain injury, contusions of the brain, or bleeds in or around the brain of differing severities. Some of the major limitations of the current study are that the cause of the TBI could not be specified (the type of TBI could be identified in <8% of the population studied), the severity of TBI (frequently measured using the Glasgow Coma Scale <sup>3</sup>) was not quantified, and severity was classified as overnight hospitalization, prolonged hospitalization, and moderate to severe TBI based on *International Classification of Diseases* codes.

Contact sports, such as football, produce repeated minor contusions, leading to chronic traumatic encephalopathy often only visible using microscopy. <sup>4</sup> The causes of brain injury related to repeated sports concussions or combat-related shock waves are different than most causes of injuries in patients who experience a TBI related to a motor vehicle collision, a fall, or even an assault, often accompanied by alcohol intoxication (estimated to be 1 million per year in the United States). The findings of the present study appear to be applicable to this more common type of TBI. Thus, of the TBI patients in the current study, 69.3% were male, 80.5% were single, and 9.3% had preexisting psychiatric disorders (including 4.4% with substance abuse). The median age of the study participants was 18.6 years at the time of the TBI and 40.6 years at premature death.

Previous studies of long-term mortality (up to 20 years) in patients with TBI have focused on factors associated with acute trauma, such as age, sex, severity of disability, <sup>5</sup> severity of injury, <sup>6</sup> and preinjury drug abuse. <sup>7</sup> The current study focused on causes of mortality.

It is interesting that similar studies of premature mortality among patients with cerebrovascular brain injury have similarly found that psychiatric disorders, particularly depression, are associated with early deaths. <sup>8</sup> <sup>9</sup> Although the current study found increased mortality associated with both depression and substance abuse, most TBI deaths were due to injuries and assaults, whereas among patients with cerebrovascular disease, deaths were due to physical illness, particularly cardiovascular disease. <sup>8</sup>

Another important finding from this study is that the association with suicide, injuries, and assaults was attenuated in the sibling controls compared with the general population controls. This finding suggests that genetic and environmental factors, which were common to both siblings and TBI patients, were in part responsible for the increased mortality associated with TBI. However, only 1.4% of the premature deaths due to injuries had TBI and substance abuse, and 1.5% of the premature deaths due to suicide had TBI and depression. Thus, premature mortality in most patients is

not explained by the existence of substance abuse or depression. For many years, TBI among young males who were intoxicated at the time of injury has been associated with personality characteristics of impulsivity and risk-taking behaviors. <sup>10</sup> Although the authors acknowledge that personality is a potential confounder in the present study, the preponderance of premature deaths due to external factors suggests that one of the most likely explanations for the findings in the current study is the existence of personality characteristics of impulsiveness, risk-taking behaviors, and proneness to substance abuse. These patients incur a TBI and continue to demonstrate these behaviors after the TBI, which ultimately leads to a fatality.

In summary, this important study has identified that a small proportion of TBI patients will have a premature death primarily associated with injuries, assaults, and suicide. As the authors indicate, the need to recognize these patients is an important task because half of these deaths are due to preventable behaviors. Further studies in this area should focus on whether the cause of brain injury, type of brain injury, severity of injury, or premorbid personality characteristics are associated with the highest risk of premature deaths. These characteristics could potentially become a focus of treatment and preventive intervention. It should be acknowledged, however, that this type of study requires a large database because only 1.1% of the

TBI patients die prematurely. Perhaps screening TBI patients at the time of discharge for personality characteristics and treating those with the most impulsive risk-taking traits or preventing depression by administering antidepressants would be the most cost-effective prevention intervention. In any event, given the enormity of TBI in young people, we need to find the most efficient ways to identify those with greatest risk and the most effective ways to prevent premature deaths after TBI.

## Article Information

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## References

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1 

Fazel S, Wolf A, Pilas D, Lichtenstein P, Långström N. Suicide, fatal injuries, and other causes of premature mortality in patients with traumatic brain injury: a 41-Year Swedish Population Study [published

online January 15, 2014]. *JAMA Psychiatry*. doi:10.1001/jamapsychiatry.2013.3935.

[PubMed](#)

**2** [↩](#)

Wallace D. Improvised explosive devices and traumatic brain injury: the military experience in Iraq and Afghanistan. *Australas Psychiatry*. 2009;17(3):218-224.

[PubMed](#)

**3** [↩](#)

Teasdale G, Jennett B. Assessment of coma and impaired consciousness: a practical scale. *Lancet*. 1974;2(7872):81-84.

[PubMed](#)

**4** [↩](#)

Omalu BI, DeKosky ST, Hamilton RL, et al Chronic traumatic encephalopathy in a National Football League player: part II. *Neurosurgery*. 2006;59(5):1086-1092.

[PubMed](#)

**5** [↩](#)

Brooks JC, Strauss DJ, Shavelle RM, Paculdo

DR, Hammond FM, Harrison-Felix CL. Long-term disability and survival in traumatic brain injury: results from the National Institute on Disability and Rehabilitation Research model systems. *Arch Phys Med Rehabil.* 2013;94(11):2203-2209.

[PubMed](#)

**6** [↩](#)

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.

[PubMed](#)

**7** [↩](#)

Baguley IJ, Nott MT, Howle AA, et al. Late mortality after severe traumatic brain injury in New South Wales: a multicentre study. *Med J Aust.* 2012;196(1):40-45.

[PubMed](#)

**8** [↩](#)

Morris PL, Robinson RG, Andrzejewski P, Samuels J, Price TR. Association of depression with 10-year poststroke mortality. *Am J Psychiatry.* 1993;150(1):124-129.

[PubMed](#)

9 

House A, Knapp P, Bamford J, Vail A. Mortality at 12 and 24 months after stroke may be associated with depressive symptoms at 1 month. *Stroke*. 2001;32(3):696-701.

[PubMed](#)

10 

Sela-Kaufman M, Rassovsky Y, Agranov E, Levi Y, Vakil E. Premorbid personality characteristics and attachment style moderate the effect of injury severity on occupational outcome in traumatic brain injury: another aspect of reserve. *J Clin Exp Neuropsychol*. 2013;35(6):584-595.

[PubMed](#)