



Global burden of traumatic brain and spinal cord injury



Nancy Pierce/Science Photo Library

Published Online

November 26, 2018

[http://dx.doi.org/10.1016/](http://dx.doi.org/10.1016/S1474-4422(18)30444-7)

[S1474-4422\(18\)30444-7](http://dx.doi.org/10.1016/S1474-4422(18)30444-7)

See [Articles](#) page 56

Traumatic brain injury (TBI) and spinal cord injury (SCI) are devastating conditions with far-reaching physical, emotional, and economic consequences for patients, families, and society at large. In *The Lancet Neurology*, the Global Burden of Diseases, Injuries, and Risk Factors (GBD) 2016 TBI and SCI Collaborators provide a rigorous and comprehensive analysis of the global, regional, and national burden of TBI and SCI from 1990 to 2016.¹ In addition to providing point estimates for the incidence, prevalence, and years of life lived with disability (YLD) of TBI and SCI by country, the Collaborators examine how these measures have changed with time. This Article has several important messages that merit close consideration.

First, the global age-standardised incidence (percentage change 3.6% [95% uncertainty interval 1.8–5.5]), prevalence (8.4% [7.7–9.2]), and YLD (3.6% [1.8–5.5]) rates for TBI rose significantly between 1990 and 2016. Although these rates did not change significantly for SCI between 1990 and 2016, the total number of patients living with SCI is also likely to be increasing because the global population is increasing. The main causes of these injuries across most geographical locations were falls and road traffic accidents, suggesting that interventions targeting fall prevention and improved road safety should be key public health priorities. Furthermore, policy makers and governments should be prepared to invest resources into centres specialising in multidisciplinary care for people with TBI or SCI, because available systems are likely to become overburdened. Infrastructural changes at a health-care-systems level might be necessary to establish appropriate clinical care pathways and improve timely access to quality care.

Second, although the age-standardised incidence of TBI in 2016 was nearly 30 times greater than that of SCI (369 per 100 000 vs 13 per 100 000), the age-standardised prevalence of TBI was only about double that of SCI (759 per 100 000 vs 368 per 100 000), and the age-standardised YLD rate for TBI was lower than that of SCI (111 per 100 000 vs 130 per 100 000). These differences between TBI and SCI are probably because of the higher case-fatality rate of TBI (ie, higher acute mortality from injury), although this effect should at least be partly offset by the higher standardised mortality ratios for SCI (ie, poorer long-term life

expectancy for those who survive SCI).^{2,3} Nonetheless, we can reasonably conclude from these data that the long-term burden of SCI for patients, caregivers, health-care systems, and the economy exceeds that of TBI.

Third, this study showed that the age-standardised incidence and prevalence of SCI remained stable globally from 1990 to 2016. However, with demographic shifts, the overall pattern and morphology of these injuries are likely to have changed despite stability in the overall incidence, and such changes in distribution might vary by geographical region. Therefore, it would be prudent to examine how the age composition and patterns and mechanisms of injury among patients with SCI (and TBI) have changed over time and across different locations. A US study,⁴ for example, showed that the mean age of patients who had an SCI rose from 40 years in 1993 to 50 years in 2012. An increasing proportion of injuries occurred in older patients (ie, ≥ 65 years) secondary to falls.⁴ Similar trends have been reported in other high-income countries, both for SCI^{5,6} and TBI.⁷ This shift in the demographics of SCI and TBI is important because the acute care and rehabilitation of older patients with SCI or TBI present unique challenges, the health-care resources consumed are greater, and the outcomes are poorer than those in young patients.^{8,9} For example, older patients often have substantial comorbidities, and hence might be less able than younger patients to tolerate the extensive surgeries that can be indicated for severe SCI or TBI.¹⁰

The GBD 2016 TBI and SCI Collaborators' study was made possible by the resources and wealth of information contained within the GBD 2016 framework, and makes use of all accessible data, including inpatient and outpatient health records, literature studies, and survey data. The uniform modelling strategy (based on Bayesian algorithms) and calculation of age-standardised epidemiological estimates permit comparisons between countries with different population distributions. Limitations include potential underestimation of the true incidence of TBI, as the authors point out, because of the failure to capture cases of mild TBI or concussion in patients who do not seek medical care. Furthermore, without stratification of SCI severity—eg, by the American Spinal Injury Association Impairment Scale (AIS) or Frankel grading—the true burden of disability

attributable to SCI is difficult to appreciate fully. The consequences of an AIS grade A (ie, complete) SCI, for example, are very different from those of an AIS grade D injury. With additional data from large regional, national, and international registries of patients with SCI, we hope that future iterations of this study will be appropriately positioned to provide more accurate and granular estimates of the burden of SCI.

All in all, the GBD 2016 TBI and SCI Collaborators' study is a formidable undertaking and the authors are to be congratulated for this important contribution to the literature. This study serves as a sobering reminder that, despite improvements in access to, and quality of, trauma care, the effects of neurotrauma continue to loom large on a global scale. We hope, however, that, by illuminating the ongoing and profound effects of TBI and SCI internationally, studies such as this one will inspire and invigorate clinicians, researchers, and policy makers to redouble efforts to develop improved prevention and treatment strategies.

Jetan H Badhiwala, Jefferson R Wilson, *Michael G Fehlings
Division of Neurosurgery, Department of Surgery, University of Toronto, Toronto, ON, Canada (JHB, JRW, MGF); Division of Neurosurgery, Toronto Western Hospital, University Health

Network, Toronto, ON, Canada (JHB, MGF); and Division of Neurosurgery, St Michael's Hospital, Toronto, ON, Canada (JRW)
michael.fehlings@uhn.ca

We declare no competing interests.

Copyright © 2018 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.

- 1 GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators. Global, regional, and national burden of traumatic brain injury and spinal cord injury, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol* 2018; published online Nov 26. [http://dx.doi.org/10.1016/S1474-4422\(18\)30415-0](http://dx.doi.org/10.1016/S1474-4422(18)30415-0).
- 2 Middleton JW, Dayton A, Walsh J, Rutkowski SB, Leong G, Duong S. Life expectancy after spinal cord injury: a 50-year study. *Spinal Cord* 2012; **50**: 803–11.
- 3 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**: 2203–09.
- 4 Jain NB, Ayers GD, Peterson EN, et al. Traumatic spinal cord injury in the United States, 1993–2012. *JAMA* 2015; **313**: 2236–43.
- 5 Lee BB, Cripps RA, Fitzharris M, Wing PC. The global map for traumatic spinal cord injury epidemiology: update 2011, global incidence rate. *Spinal Cord* 2014; **52**: 110–16.
- 6 Singh A, Tetreault L, Kalsi-Ryan S, Nouri A, Fehlings MG. Global prevalence and incidence of traumatic spinal cord injury. *Clin Epidemiol* 2014; **6**: 309–31.
- 7 Peeters W, van den Brande R, Polinder S, et al. Epidemiology of traumatic brain injury in Europe. *Acta Neurochir* 2015; **157**: 1683–96.
- 8 Ahn H, Bailey CS, Rivers CS, et al. Effect of older age on treatment decisions and outcomes among patients with traumatic spinal cord injury. *CMAJ* 2015; **187**: 873–80. 9 Marquez de la Plata CD, Hart T, Hammond FM, et al. Impact of age on long-term recovery from traumatic brain injury. *Arch Phys Med Rehabil* 2008; **89**: 896–903.
- 10 Partridge JS, Harari D, Dhesei JK. Frailty in the older surgical patient: a review. *Age Ageing* 2012; **41**: 142–47.

Statistics on the burden of dementia: need for stronger data



Dementia primarily affects an individual's cognitive function and many aspects of life are negatively affected by cognitive decline. There are no approved disease-modifying drugs and no approved prevention strategies for dementia; a heavy burden is placed on the individual who has dementia, their family, and society. In *The Lancet Neurology*, a report¹ from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2016 Dementia Collaborators presents estimates of dementia-related deaths, prevalence, quality of life measures, and risk factors, with the aim of documenting global patterns and providing data for research, and to guide a wide range of public health investments.

Calculations were based on the GBD models that have been used to estimate the burden of more than 300 diseases and injuries in 195 countries and territories.³ Because of the marked inconsistencies in the

location-specific data for prevalence and incidence of dementia and mortality, and the marked heterogeneity in the studies included in this report, several of the assumptions that are usually used in the GBD methods could not be met. Therefore, the type of source data used and the modelling approaches were modified so that the data fitted the assumptions of the core GBD models. For example, for locations that did not have data available it appeared that the ratio of prevalence to cause-specific mortality from the USA, Puerto Rico, Finland, and Sweden were incorporated to estimate cause of death, prevalence, quality of life, and risk factors for dementia.

The report¹ makes an important point about the huge burden of dementia: in 2016, the global number of individuals who lived with dementia was 43.8 million (95% uncertainty interval [UI] 37.8–51.0), increased from 20.2 million (17.4–23.5) in 1990. The report also



Published Online
November 26, 2018
[http://dx.doi.org/10.1016/S1474-4422\(18\)30456-3](http://dx.doi.org/10.1016/S1474-4422(18)30456-3)
See [Articles](#) page 88