

Sex, Gender, and Traumatic Brain Injury: Implications for Better Science and Practice

CATEGORIES: Living with Brain Injury, Research

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The impact of traumatic brain injury (TBI) can be far reaching and affects more than the health and wellbeing of those with brain injury and persons close to them. Great strides have been made in exploring the many facets of brain injury – medical, personal, and environmental factors that impact risk of injury, cause of injury, and its course of recovery. However, one topic in particular remains largely unexplored, despite its crucial role as a determinant of injury vulnerability, post-injury experience, and extent of recovery. The topic in question is that of the effect of sex and gender, which is now being highly recognized for its importance to good science and practice.

What role do sex and gender play in brain injury?

Sex refers to biological differences between men and women, including genetic specificities that distinguish them with respect to hormonal levels and rates of metabolism, and anatomy (e.g., skull thickness, brain size, etc.). In the context of TBI, these differences between men and women can affect differences in susceptibility to TBI after physical trauma and regeneration among other factors. **Gender** refers to the social and cultural processes that shape the experiences of men and women, before, at the time of, and after their injury. It is, however, difficult to separate the individual effects of sex from those of gender in a person who sustains TBI.

Gender affects health directly in the context of TBI. For example, men more often participate in higher risk behaviors that can cause injury, worsen the effects of previous injury, or increase the risk of repetitive injury. The effect of gender on health is also indirect. It creates different home and professional workloads for men and women and impacts the time they can dedicate to health maintenance, recovery after injury, and whether they can easily and openly acknowledge their

health issues. Finally, gender impacts the social aspects of health after brain injury. Society's gender-based perceptions fault men and women for their circumstances, possibly misinterpret complaints, or fail to take complaints seriously. In doing so, society creates standards and associated pressures with respect to rate and extent of recovery and return to previous roles.

What sex and gender differences have been reported in brain injury research?

The National Institutes of Health and federal funding agencies in Canada and Europe have acknowledged that medicine is dominated by findings on men and that there is insufficient data to inform clinical decision-making that considers the unique experiences and needs of women in all areas of medicine, including brain injury. Some examples of sex and gender differences that have been reported in brain injury research are as follows:

- Hospitalizations
 - Men have a higher incidence of TBI than women, particularly during young adulthood.
 - Hospitalization rates between men and women even out in older adulthood as injury rates become similar.
 - Men more often leave hospital after admission against medical advice.
 - The highest rates for concussion, or mild TBI, among older adults are among women.
 - Girls and women with a concussion-related emergency department visit have a higher reported rate of concurrent neck injury than boys and men. This is true across injury causes, including motor vehicle collisions, assault, and sport-related injuries.
- Work-Related Brain Injury
 - Most work-related TBI fatalities occur in men; the jobs and workplaces of men are associated with more severe injuries.
 - Women are at a greater risk of sustaining work-related TBI due to assault, often in the healthcare, social services, and education sectors
 - Men experience higher rates of work-related TBI in law enforcement and public administration.
 - Women are more proactive in seeking medical and rehabilitation services.
 - Women report more positive return-to-work outcomes if coming from traditionally “feminine” environments (i.e., healthcare, social care) relative to those in more “masculine” environments.
- Sports-Related Brain Injury

- In a study of young adults who sustained sports-related concussions, young women expressed greater intention to report than men.
- Men more often exhibit on-field markers of injury such as amnesia and disorientation.
- Women more frequently report headache, drowsiness, and nausea/vomiting.
- Life after Brain Injury
 - Being a man is associated with a greater likelihood of aggression after TBI relative to women.
 - Women are significantly more likely to die from a head injury than men.
 - Women are more likely to die from a head injury by assault.
 - Women experiencing intimate partner violence (IPV) are at a high risk of brain injury, with up to 90% of incidents of IPV involving hits to the head or strangulation.

What other research strides have been made?

In December 2017, the “Understanding TBI in Women” workshop took place. This seminal event was hosted by the NIH, in partnership with the Center for Neuroscience and Regenerative Medicine and the Defense and Veterans Brain Injury Center. The two-day workshop brought together researchers, persons affected by brain injury, and clinicians to identify knowledge gaps, best practices, and target populations relevant to research on sex differences and women with TBI. These proceedings, which will be published in a scientific journal, highlight epidemiological trends, populations such as sports-related injuries and women affected by intimate partner violence, and findings from animal studies.

Dr. Colantonio is the founding chair of the Girls and Women with Acquired Brain Injury Task Force of the American Congress of Rehabilitation Medicine, the world’s largest interdisciplinary research organization with a major focus on rehabilitation after brain injury. This task force would not be possible without the support of Marilyn Spivack, founder of the Brain Injury Association of America, who participated in the initial international workshop on Women and TBI in 2010 and advocated for the task force. Members of the task force are often invited to testify at Congressional meetings.

The task force has been meeting since 2011 and is supported by researchers, clinicians, and advocates. One of the products of the task force was a first-of-its-kind special issue in the Archives of Physical Medicine and Rehabilitation entitled “Sex, Gender and Traumatic Brain Injury” published in 2016. The issue is freely [available online](#).

While there is still much work to be done, we must also be inspired by the progress that has been made. For more information about sex, gender, and brain injury, please visit www.abiresearch.utoronto.ca.

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References

Albrecht JS, Hirshon JM, McCunn M, Bechtold KT, Rao V, Simoni-Wastila L, Smith GS. Increased Rates of Mild Traumatic Brain Injury Among Older Adults in US Emergency Departments, 2009-2010. *J Head Trauma Rehabil.* 2016 Sep-Oct;31(5):E1-7.

Chan V, Mollayeva T, Ottenbacher KJ, Colantonio A. Sex-Specific Predictors of Inpatient Rehabilitation Outcomes After Traumatic Brain Injury. *Arch Phys Med Rehabil.* 2016 May;97(5):772-80.

Chang VC, Ruseckaite R, Collie A, Colantonio A. Examining the epidemiology of work-related traumatic brain injury through a sex/gender lens: analysis of workers' compensation claims in Victoria, Australia. *Occup Environ Med.* 2014 Oct;71(10):695-703.

Colantonio A, Saverino C, Zagorski B, Swaine B, Lewko J, Jaglal S, Vernich L. Hospitalizations and emergency department visits for TBI in Ontario. *Can J Neurol Sci.* 2010 Nov;37(6):783-90.

Elbogen EB, Wolfe JR, Cueva M, Sullivan C, Johnson J. Longitudinal Predictors of Criminal Arrest After Traumatic Brain Injury: Results From the Traumatic Brain Injury Model System National Database. *J Head Trauma Rehabil.* 2015 Sep-Oct;30(5):E3-13.

Gilthorpe MS, Wilson RC, Moles DR, Bedi R. Variations in admissions to hospital for head injury and assault to the head. Part 1: Age and gender. *Br J Oral Maxillofac Surg.* 1999 Aug;37(4):294-300.

Kim H, Colantonio A, Bayley M, Dawson D. Discharge against medical advice after traumatic brain injury: is intentional injury a predictor? *J Trauma.* 2011 Nov;71(5):1219-25.

Kroshus E, Baugh CM, Stein CJ, Austin SB, Calzo JP. Concussion reporting, sex, and conformity to traditional gender norms in young adults. *J Adolesc.* 2017 Jan;54:110-119.

McGlade E, Rogowska J, Yurgelun-Todd D. Sex differences in orbitofrontal connectivity in male and female veterans with TBI. *Brain Imaging Behav.* 2015 Sep;9(3):535-49. doi: 10.1007/s11682-015-9379-3.

Mollayeva T, Mollayeva S, Colantonio A. Traumatic brain injury: sex, gender and intersecting vulnerabilities. *Nat Rev Neurol.* 2018 Dec;14(12):711-722.

Mollayeva T, Mollayeva S, Lewko J, Colantonio A. Sex differences in work-related traumatic brain injury due to assault. *Work*. 2016 Jun 16;54(2):415-23.

McGuire C, Kristman VL, Martin L, Bédard M. Characteristics and Incidence of Traumatic Brain Injury in Older Adults Using Home Care in Ontario from 2003-2013. *Can Geriatr J*. 2017 Mar 31;20(1):2-9. doi: 10.5770/cgj.20.228. eCollection 2017 Mar.

National Institutes of Health. [Sex and Gender In Health and Disease](#) (2000).

National Institutes of Neurological Disorders and Stroke. [Understanding Women in TBI](#) (2017).

Nikoo M, Gadermann A, To MJ, Krausz M, Hwang SW, Palepu A. Incidence and Associated Risk Factors of Traumatic Brain Injury in a Cohort of Homeless and Vulnerably Housed Adults in 3 Canadian Cities. *J Head Trauma Rehabil*. 2017 Jul/Aug;32(4):E19-E26.

Reid MW, Miller KJ, Lange RT, Cooper DB, Tate DF, Bailie J, Brickell TA, French LM, Asmussen S, Kennedy JE. A multisite study of the relationships between blast exposures and symptom reporting in a post-deployment active duty military population with mild traumatic brain injury. *J Neurotrauma*. 2014 Dec 1;31(23):1899-906.

Russell LM, Devore MD, Barnes SM, Forster JE, Hostetter TA, Montgomery AE, Casey R, Kane V, Brenner LA. Challenges associated with screening for traumatic brain injury among US veterans seeking homeless services. *Am J Public Health*. 2013 Dec;103 Suppl 2:S211-2.

Oddy M, Moir JF, Fortescue D, Chadwick S. The prevalence of traumatic brain injury in the homeless community in a UK city. *Brain Inj*. 2012;26(9):1058-64.

St Ivany A, Schminkey D. Intimate Partner Violence and Traumatic Brain Injury: State of the Science and Next Steps. *Fam Community Health*. 2016 Apr-Jun;39(2):129-37.

Stergiou-Kita M, Mansfield E, Sokoloff S, Colantonio A. Gender Influences on Return to Work After Mild Traumatic Brain Injury. *Arch Phys Med Rehabil*. 2016 Feb;97(2 Suppl):S40-5.

Sullivan L, Molcho M. Gender differences in concussion-related knowledge, attitudes and reporting-behaviors among high school student-athletes. *Int J Adolesc Med Health*. 2018 Oct 24. pii: /j/ijamh.ahead-of-print/ijamh-2018-0031/ijamh-2018-0031.xml. doi: 10.1515/ijamh-2018-0031. [Epub ahead of print]

Sutton M, Chan V, Escobar M, Mollayeva T, Hu Z, Colantonio A. Neck Injury Comorbidity in Concussion-Related Emergency Department Visits: A Population-Based Study of Sex Differences Across the Life Span. *J Womens Health (Larchmt)*. 2018 Dec 28. doi: 10.1089/jwh.2018.7282. [Epub ahead of print]

Wasserman EB, Kerr ZY, Zuckerman SL, Covassin T. Epidemiology of Sports-Related Concussions in National Collegiate Athletic Association Athletes From 2009-2010 to 2013-2014: Symptom Prevalence, Symptom Resolution Time, and Return-to-Play Time. *Am J Sports Med.* 2016 Jan;44(1):226-33.

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