

alternative access to rather than inappropriate actions by the patient.<sup>2</sup>

More than 50% of all acute care visits by the uninsured are to emergency physicians, who comprise less than 5% of the total number of physicians in the United States.<sup>3</sup> In addition, for the general population, we must consider the possibility that EDs are not, in fact, significantly over-used at all.

Evidence would suggest that people are not increasingly reliant on EDs to meet ambulatory care needs. Between 1999 and 2009, total ambulatory visits increased from 841 million to 1.13 billion, or 3720 visits per 1000 people annually.<sup>4</sup> During this same period, the number of ED visits increased from approximately 108 million to 124 million, which is a slower rate of growth.<sup>4,5</sup>

In other words, total ambulatory visits increased more quickly than ED visits, implying that patients are finding accessible ambulatory care, at least if they have insurance. Visits to the ED currently make up a lower proportion of total ambulatory visits than the prior decade. The growth of ED visits might not signal a problem at all, but rather that our health care system is undergoing fundamental change.

This change includes a shift away from inpatient use and toward outpatient care, especially for the increasing numbers of patients with complex illnesses.<sup>4</sup> During the same period, there has been a decline in hospitalizations, which would not have been achievable without highly effective ambulatory services, backed up by 24-hour, relatively unconstrained access to high-intensity, high-quality emergency care.

As policy makers look to optimize models for health care delivery, it should not be presumed that that ED use rates, in isolation, are somehow an indicator of quality or cost-effectiveness. Immediate ED access is an important part of the portfolio of health care services provided to a population.

The proposal by Cowling and Majeed to focus on population health is quite wise. Reducing the cost of health care is most effectively achieved when the need for health care is reduced. In doing so, policy makers should focus less on ED use alone and instead focus on whether patients have accessible, cost-effective medical services that will achieve desired health outcomes. As coordinated solutions to achieve this end are implemented, the absolute number of ED visits may not decrease, although their proportion in relation to overall ambulatory visits may indeed decline further.

James G. Adams, MD

**Author Affiliation:** Department of Emergency Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois (jadams@nmh.org).

1. Gindi RM, Cohen RA, Kirzinger WK. Emergency room use among adults aged 18–64: early release of estimates from the National Health Interview Survey, January–June 2011. <http://www.cdc.gov/nchs/nhis/releases.htm>. Accessed April 30, 2013.

2. Kellermann AL, Weinick RM. Emergency departments, Medicaid costs, and access to primary care—understanding the link. *N Engl J Med*. 2012;366(23):2141–2143.

3. Pitts SR, Carrier ER, Rich EC, Kellermann AL. Where Americans get acute care: increasingly, it's not at their doctor's office. *Health Aff (Millwood)*. 2010;29(9):1620–1629.

4. Barnett ML, Song Z, Landon BE. Trends in physician referrals in the United States, 1999–2009. *Arch Intern Med*. 2012;172(2):163–170.

5. National Center for Health Statistics. NAMCS/NHAMCS main site. <http://www.cdc.gov/nchs/ahcd.htm>. Accessed April 30, 2013.

## RESEARCH LETTER

### Prevalence and Correlates of Traumatic Brain Injuries Among Adolescents

**To the Editor:** Traumatic brain injury (TBI) among adolescents has been identified as an important health priority.<sup>1,2</sup> However, studies of TBI among adolescents in large representative samples are lacking.<sup>1,2</sup> This information is important to the planning and evaluation of injury prevention efforts, particularly because even minor TBI may have important adverse consequences.<sup>2</sup>

We describe the prevalence of TBI, mechanisms of injury, and adverse correlates in a large representative sample of adolescents living in Ontario, Canada.

**Methods.** Data were derived from the Centre for Addiction and Mental Health's 2011 Ontario student drug use and health survey, consisting of anonymous, self-administered questionnaires completed in classrooms (62% response rate) by students grades 7–12 (age range: 11–20 years). A complete description of the study, including design and discussion of the validity of self-reports, potential nonresponse bias, and limitations, is available.<sup>3</sup>

Traumatic brain injury was defined as an acquired head injury in which the student was unconscious for at least 5 minutes or hospitalized overnight.<sup>4</sup> Students were asked if they ever had such injury in the past 12 months or in their lifetime (excluding the past 12 months). Students reporting TBI in the past 12 months were asked about the source of the injury. Questions about consumption of alcohol and cannabis use during the last 12 months and usual grades received were also included.

All participants provided signed and parental consent. Research ethics board approval was provided by the Centre for Addiction and Mental Health, York University, and public and Catholic school boards throughout Ontario. The surveys were administered during a class period by field staff. Analyses were based on a complex sample design with 15 strata (region × school level), 181 primary sampling units (schools), and 8915 students.

All analyses used Taylor series linearization available in the complex sample module in SPSS version 20.0 (SPSS Inc). Multinomial logistic regression was performed fitting the 5 factors of sex, grade, past-year alcohol use, past-year cannabis use, and school grades against a 2-tailed  $P < .05$ .

**Results.** The mean (SD) age of participants was 15.1 (1.82) years. The estimated lifetime prevalence of TBI was 20.2% (95% CI, 18.1%–22.4%); 5.6% (95% CI, 4.2%–7.5%) reported at least 1 TBI in the past 12 months (4.3% of girls and 6.9% of boys) and 14.6% (95% CI, 13.4%–15.9%) re-

©2013 American Medical Association. All rights reserved.

ported a TBI in their lifetime but not in the past 12 months (12.8% of girls and 16.2% of boys) (eTable available at <http://www.jama.com>).

Sports injuries accounted for more than half of the cases in the past 12 months (56%; 95% CI, 50.5%-63.0%) and were more common among males (46.9% in girls and 63.3% in boys). The multinomial logistic regression model distinguished differences among the 3 TBI groups (lifetime, past 12 months, never) (Wald  $F_{34,133} = 17.95$ ,  $P < .001$ ).

The odds ratio for a lifetime TBI (excluding the past 12 months) was 3.93 (95% CI, 2.13-7.27) for students who reported poor school grades compared with those with high grades (TABLE). Students who reported occasional to frequent consumption of alcohol and cannabis in the past 12 months had significantly higher odds of TBI in the past 12 months than abstainers.

**Discussion.** Twenty percent of Ontario students in grades 7-12 in this provincewide school survey reported a TBI at

some point in their life, and 5.6% sustained a TBI in the last 12 months. In the United States, more than half a million adolescents aged 15 years or younger require hospital-based care for head injury annually,<sup>2</sup> and our data suggest a much higher number of adolescents may be experiencing these injuries.

The relationship among TBI, substance use, and poorer academic performance needs further investigation. The magnitude of the prevalence estimates and the associated risks identified within this representative sample support suggestions to improve understanding, prevention, and response to TBI among adolescents.<sup>1-3,5,6</sup>

Possible bias related to self-report procedures and the preclusion of causal inferences due to the cross-sectional nature of the data are limitations of this study. Even though our data did not present evidence of appreciable bias overall,<sup>3</sup> nonresponse bias may exist. Future studies should examine long-term outcomes of injury.

**Table.** Multinomial Logistic Regression for Traumatic Brain Injury (N = 8915 Students)<sup>a</sup>

|                                  | Odds Ratio (95% CI)                       |                                | Adjusted Odds Ratio (95% CI)              |                               | Wald Statistic <sup>c,d</sup> |
|----------------------------------|---|--------------------------------|---|-------------------------------|-------------------------------|
|                                  | TBI During Lifetime vs Never <sup>b</sup> | TBI in Past 12 Mo vs Never     | TBI During Lifetime vs Never <sup>b</sup> | TBI in Past 12 Mo vs Never    |                               |
| Sex                              |   |                                |   |                               |                               |
| Female                           | 1 [Reference]                             | 1 [Reference]                  | 1 [Reference]                             | 1 [Reference]                 | $F_{2,165} = 11.15$           |
| Male                             | 1.36 (1.18-1.56) <sup>d</sup>             | 1.72 (1.23-2.39) <sup>e</sup>  | 1.33 (1.15-1.53) <sup>d</sup>             | 1.76 (1.31-2.37) <sup>d</sup> |                               |
| Grade                            |   |                                |   |                               |                               |
| 12                               | 1 [Reference]                             | 1 [Reference]                  | 1 [Reference]                             | 1 [Reference]                 | $F_{10,157} = 4.49$           |
| 11                               | 1.40 (0.91-2.18)                          | 0.95 (0.58-1.55)               | 1.39 (0.97-1.99)                          | 1.04 (0.68-1.60)              |                               |
| 10                               | 1.34 (0.86-2.07)                          | 1.06 (0.60-1.86)               | 1.48 (1.01-2.15) <sup>f</sup>             | 1.55 (0.93-2.58)              |                               |
| 9                                | 1.05 (0.79-1.40)                          | 0.87 (0.47-1.60)               | 1.30 (0.96-1.75)                          | 1.66 (0.79-3.45)              |                               |
| 8                                | 1.20 (0.87-1.66)                          | 1.17 (0.54-2.56)               | 1.65 (1.19-2.29) <sup>e</sup>             | 3.50 (1.60-7.64) <sup>e</sup> |                               |
| 7                                | 1.10 (0.79-1.54)                          | 0.63 (0.29-1.37)               | 1.64 (1.16-2.30) <sup>e</sup>             | 2.35 (1.03-5.35) <sup>f</sup> |                               |
| Alcohol consumption <sup>g</sup> |   |                                |   |                               |                               |
| Never                            | 1 [Reference]                             | 1 [Reference]                  | 1 [Reference]                             | 1 [Reference]                 | $F_{6,161} = 10.03$           |
| Lifetime <sup>b</sup>            | 1.45 (0.78-2.68)                          | 2.56 (1.00-6.53)               | 1.41 (0.78-2.54)                          | 2.58 (1.09-6.09) <sup>f</sup> |                               |
| Infrequently                     | 1.41 (1.09-1.81) <sup>f</sup>             | 3.21 (1.81-5.71) <sup>d</sup>  | 1.40 (1.06-1.84) <sup>f</sup>             | 3.27 (1.93-5.52) <sup>d</sup> |                               |
| Occasionally                     | 2.03 (1.33-3.09) <sup>f</sup>             | 7.16 (4.61-11.11) <sup>d</sup> | 1.68 (0.99-2.87)                          | 5.57 (3.39-9.16) <sup>d</sup> |                               |
| Cannabis use <sup>g</sup>        |   |                                |   |                               |                               |
| Never                            | 1 [Reference]                             | 1 [Reference]                  | 1 [Reference]                             | 1 [Reference]                 | $F_{8,159} = 6.35$            |
| Lifetime <sup>b</sup>            | 1.79 (1.27-2.51) <sup>e</sup>             | 1.59 (0.73-3.48)               | 1.56 (1.07-2.28) <sup>f</sup>             | 1.28 (0.52-3.15)              |                               |
| 1-2 times                        | 1.31 (0.91-1.88)                          | 3.11 (1.98-4.89) <sup>d</sup>  | 1.15 (0.78-1.70)                          | 2.37 (1.43-3.92) <sup>e</sup> |                               |
| 3-9 times                        | 1.50 (0.84-2.67)                          | 3.40 (1.82-6.33) <sup>d</sup>  | 1.24 (0.70-2.18)                          | 2.67 (1.63-4.40) <sup>d</sup> |                               |
| ≥ 10 times                       | 1.69 (1.12-2.55) <sup>f</sup>             | 4.28 (3.05-6.02) <sup>d</sup>  | 1.27 (0.82-1.96)                          | 3.17 (2.01-5.02) <sup>d</sup> |                               |
| Average grades, %                |   |                                |   |                               |                               |
| 90-100                           | 1 [Reference]                             | 1 [Reference]                  | 1 [Reference]                             | 1 [Reference]                 | $F_{8,159} = 6.35$            |
| 80-89                            | 1.23 (0.91-1.66)                          | 1.60 (0.93-2.75)               | 1.18 (0.86-1.62)                          | 1.41 (0.80-2.49)              |                               |
| 70-79                            | 1.34 (0.95-1.89)                          | 1.20 (0.65-2.19)               | 1.17 (0.82-1.66)                          | 0.80 (0.44-1.46)              |                               |
| 60-69                            | 2.38 (1.66-3.35) <sup>d</sup>             | 1.97 (0.96-4.04)               | 1.87 (1.33-2.65) <sup>d</sup>             | 1.01 (0.49-2.10)              |                               |
| < 60                             | 4.98 (2.84-8.74) <sup>d</sup>             | 4.81 (1.77-13.06) <sup>e</sup> | 3.93 (2.13-7.27) <sup>d</sup>             | 2.14 (0.82-5.60)              |                               |

<sup>a</sup>Data were derived from the Centre for Addiction and Mental Health's 2011 Ontario student drug use and health survey. Listwise deletion resulted in the following numbers and percentages of students: never (n=7193; 74.2%), lifetime (excluding past 12 months; n=1258; 20.2%), and past year (n=464; 5.6%).

<sup>b</sup>Lifetime excluded events occurring during the past 12 months.

<sup>c</sup>In complex samples, the degrees of freedom are calculated as follows: (number of schools) - (number of strata).

<sup>d</sup>Significant at 2-tailed  $P < .001$ .

<sup>e</sup>Significant at 2-tailed  $P < .01$ .

<sup>f</sup>Significant at 2-tailed  $P < .05$ .

<sup>g</sup>Reflects consumption during the past 12 months.

Gabriela Ilie, PhD  
 Angela Boak, MA  
 Edward M. Adlaf, PhD  
 Mark Asbridge, PhD  
 Michael D. Cusimano, MD, PhD

**Author Affiliations:** Injury Prevention Research Office (Dr Ilie; [gilie@utsc.utoronto.ca](mailto:gilie@utsc.utoronto.ca)) and Division of Neurosurgery (Dr Cusimano), St Michael's Hospital, Toronto, Ontario, Canada; Social and Epidemiological Research, Centre for Addiction and Mental Health, Toronto, Ontario, Canada (Ms Boak and Dr Adlaf); and Department of Community Health and Epidemiology, Dalhousie University, Halifax, Nova Scotia, Canada (Dr Asbridge).

**Author Contributions:** Dr Ilie had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Study concept and design:** Ilie, Boak, Asbridge, Cusimano.

**Acquisition of data:** Boak, Adlaf.

**Analysis and interpretation of data:** Ilie, Boak, Adlaf, Cusimano.

**Drafting of the manuscript:** Ilie, Boak.

**Critical revision of the manuscript for important intellectual content:** Ilie, Boak, Adlaf, Asbridge, Cusimano.

**Statistical analysis:** Ilie.

**Obtained funding:** Asbridge, Cusimano.

**Administrative, technical, or material support:** Boak, Adlaf.

**Study supervision:** Cusimano.

**Conflict of Interest Disclosures:** The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

**Funding/Support:** This work was supported by a team grant from the Strategic Teams in Applied Injury Research Program of the Canadian Institutes of Health Research. Additional funding was obtained from a grant from AUTO21, a member of the Networks of Centres of Excellence program that is administered and funded by the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research, and the Social Sciences and Humanities Research Council, in partnership with Industry Canada.

**Role of the Sponsor:** The funding organizations had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

**Online-Only Material:** The eTable is available at <http://www.jama.com>.

**Additional Contributions:** We thank Robert E. Mann, PhD, Hayley Hamilton, PhD, and Jürgen Rehm, PhD (all 3 with the Social and Epidemiological Research, Cen-

tre for Addiction and Mental Health, Toronto, Ontario, Canada), for their contributions to the manuscript. None received compensation for his or her contribution; however, Drs Mann, Hamilton, and Rehm acknowledge receiving ongoing funding/support from the Ontario Ministry of Health and Long-Term Care.

1. Institute of Medicine of the National Academies. Committee on sports-related concussions in youth. <http://www.iom.edu/Activities/Children/YouthSportsConcussions.aspx>. Accessed April 12, 2013.
2. Faul M, Xu L, Wald MM, Coronado VG. Traumatic brain injury in the United States: emergency department visits, hospitalizations, and deaths. [http://www.cdc.gov/traumaticbraininjury/pdf/blue\\_book.pdf](http://www.cdc.gov/traumaticbraininjury/pdf/blue_book.pdf). Accessibility verified May 29, 2013.
3. Paglia-Boak A, Adlaf EM, Mann RE. Drug use among Ontario students, 1977, 2011: detailed OSDUHS findings (CAMH research document series No. 32). [http://www.camh.ca/en/research/news\\_and\\_publications/ontario-student-drug-use-and-health-survey/Documents/2011%20OSDUHS%20Docs/2011OSDUHS\\_Detailed\\_DrugUseReport\\_2.pdf](http://www.camh.ca/en/research/news_and_publications/ontario-student-drug-use-and-health-survey/Documents/2011%20OSDUHS%20Docs/2011OSDUHS_Detailed_DrugUseReport_2.pdf). Accessibility verified May 29, 2013.
4. Tait R, Anstey K, Butterworth P. Incidence of self-reported brain injury and the relationship with substance abuse: findings from a longitudinal community survey. *BMC Public Health*. 2010;10:171.
5. Halstead ME, Walter KD; Council on Sports Medicine and Fitness; American Academy of Pediatrics. Clinical report—sport-related concussion in children and adolescents. *Pediatrics*. 2010;126(3):597-615.
6. Levy DT, Mallonee S, Miller TR, et al. Alcohol involvement in burn, submersion, spinal cord, and brain injuries. *Med Sci Monit*. 2004;10(1):CR17-CR24.

## CORRECTIONS

**Language Error in Figure:** In the Original Contribution entitled "Effect of Long-Detection Interval vs Standard-Detection Interval for Implantable Cardioverter-Defibrillators on Antitachycardia Pacing and Shock Delivery: The Advance III Randomized Clinical Trial" published in the May 8, 2013, issue of *JAMA* (2013; 309[18]:1903-1911), the labels for each panel and the y-axes in both panels of Figure 3 were incorrect. This article has been corrected online.

**Incorrect Location:** In the Medical News and Perspectives article entitled "Lessons Learned From SARS Outbreak Prompt Rapid Response to New Coronavirus," published in the April 17, 2013, issue of *JAMA* (2013;309[15]:1576-1577), the incorrect state was given for an institution. The National Institutes of Health Rocky Mountain Laboratories is in Hamilton, Montana. The article has been corrected online.