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Original quantitative research

Self-reported injuries among Canadian adolescents: rates and key correlates

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Abstract

Introduction: Injuries sustained by adolescents in Canada represent a costly public health issue. Much of the limited research in this area uses administrative data, which underestimate injury prevalence by ignoring injuries that are not treated by the health care system. Self-reported data provide population-based estimates and include contextual information that can be used to identify injury correlates and possible targets for public health interventions aimed at decreased injury burden.

Methods: The 2017 wave of the Canadian Community Health Survey was used to calculate the prevalence of self-reported total, intentional and unintentional injuries. We compared injury prevalence according to age, sex, employment status, presence of a mood disorder, presence of an anxiety disorder, smoking and binge drinking. Analyses were performed using logistic regression to identify significantly different injury prevalence estimates across key correlates.

Results: Overall past-12-month injury prevalence among adolescents living in Canada was 31.4% (95% CI: 29.4%–33.5%). Most injuries were unintentional. All provinces had estimates within a few percentage points, except Saskatchewan, which had substantially higher prevalence for both overall and unintentional injury. Smoking and binge drinking were significantly associated with higher injury prevalence in most jurisdictions. Remaining correlates exhibited nonsignificant or inconsistent associations with injury prevalence.

Conclusion: The data suggest that injury prevention interventions aimed at reducing alcohol consumption, particularly binge drinking, may be effective in reducing adolescent injury across Canada. Future research is needed to determine how provincial context (such as mental health support for adolescents or programs and policies aimed at reducing substance use) impacts injury rates.

Keywords: *wounds, injuries, adolescent, Canada, cross-sectional studies, binge drinking, smoking*

Highlights

- Self-reported data from a population-based dataset offer insight into the "hidden figure" of adolescent injury in Canada.
- Approximately 31% of adolescents aged 12 to 19 years in southern Canada reported having sustained an injury serious enough to limit their normal activities or to require medical care in the previous year.
- Most injuries were unintentional.
- Public health interventions that target adolescent alcohol consumption will likely reduce injury burden.
- Saskatchewan had a substantially greater prevalence of self-reported injury than other provinces.

Introduction

Injuries sustained by Canadians aged 10 to 19 years cost more than CAD 2.3 billion in 2010[1] and killed more members of this age group than all diseases combined.[2] Across all age groups, 60 000 Canadians are disabled and 3.5 million emergency department visits are required due to injuries each year.[1] Despite the considerable burden that injuries pose on public health, there has been little systematic research on injury prevalence and correlates among Canadian adolescents, likely because injuries are oftentimes labeled as "unlucky accidents," "random," or "unavoidable."[3-5] This mischaracterization implies that injury rates cannot be ameliorated and ignores that injury risk is unequally distributed among adolescent populations,[6] thus contributing to health inequality. Previous studies have shown that injury risk in adolescents is positively associated with lower income, being male,[5,7-9] poor mental health[10] and substance use.[7,10,11]

Much of the limited research on adolescent injury rates draws on administrative data sources such as the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP),[12] the National Ambulatory Care Reporting System (NACRS)[13] and the Discharge Abstract Database (DAD).[14] Unfortunately, these data are not population-based and, as such, injury rates based on these surveillance programs do not reflect the injury

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burden sustained outside of hospitals. These data suffer from two major limitations. First, administrative data underestimate the prevalence of injury; most injuries are unreported because they are simply ignored, not serious enough to merit medical attention, or hidden because they are the result of neglect or other forms of abuse.[5,15,16] Second, administrative datasets typically do not include demographic or contextual information, which would allow researchers to examine differences in injury rates between population groups. In contrast, self-reported data—such as those used in the current study—typically capture a wider array of injuries, details about the context in which injuries occurred, and more comprehensive sociodemographic information.

Injury research typically delineates intentional and unintentional injuries because they have different determinants. Intentional injuries are those that are inflicted upon oneself or another person deliberately, such as interpersonal violence and self-harm. Unintentional injuries are those without the deliberate intent to harm, such as injuries resulting from inclement weather, falls, sports-related injuries and unintentionally being hit by an object.[3,4,17] Although unintentional injuries are technically "accidental," it is important to remember that they often cluster in certain populations,[5-11] and the adverse health implications associated with these events are numerous and can last a long time.[18]

Determining the prevalence and correlates of self-reported injuries among Canadian adolescents is essential to identify groups that may benefit most from injury prevention–based interventions and to ultimately reduce the overall injury burden. This study used self-reported data to determine the self-reported prevalence of overall, unintentional and intentional past-12-month injuries among adolescents aged 12 to 19 years in southern Canada (provinces only), compare rates between provinces and identify key correlates.

Methods

Data

Data were drawn from the 2017 Canadian Community Health Survey (CCHS)—Annual Component.[19] This survey was administered by Statistics Canada, using both in-person and telephone surveying, and designed to be representative at the health district level. This survey collected information from Canadians aged 12 years and older about their health status, health determinants and use of health care services, among other topics.

The target population excluded individuals living on Indian Reserves and some other Indigenous settlements, Crown Lands, in parts of northern Quebec (Nunavik, Terres-Cries-de-la-Baie-James) and in institutions. Also excluded were full-time members of the Canadian Forces and people aged 12 to 17 years living in foster care. Data were not collected from these groups. Despite these exclusions, the CCHS target population covers about 98% of Canadians aged 12 years and older. Most adolescent respondents (aged 12–17) were sampled using a list frame created from the Canada Child Benefit, while all adult respondents were sampled using an area frame from the Canadian Labour Force Survey.[19]

Due to the challenges of surveying in the territories, only half of the communities are surveyed each year, meaning data are representative of the territories after two years. Consequently, all territorial respondents have been removed from the analytical sample and the estimates presented here only represent the 10 provinces.

The confidential microdata version of the CCHS was accessed through the Atlantic Research Data Centre located at Dalhousie University. Ethical approval for this study was granted by the Dalhousie Research Ethics Board.

Population

The full dataset included 58 135 respondents aged 12 years and older. However, our analytical sample included only the 5366 respondents aged 12 to 19 years, inclusive, who resided in one of the 10 Canadian provinces: British Columbia (B.C.), Alberta (Alta.), Saskatchewan (Sask.), Manitoba (Man.), Ontario (Ont.), Quebec (Que.), New Brunswick (N.B.), Nova Scotia (N.S.), Prince Edward Island (P.E.I.) and Newfoundland and Labrador (N.L.). The sample was representative of the 3 236 864 adolescents who lived in the Canadian provinces at the time.[20] Minors required active consent from a parent or guardian to participate. The national response rate for participants aged 12 to 18* years was 56.0%, ranging from 51.1% in P.E.I to 68.1% in Que.[19]

Study variables

Outcome

"Overall injury" was operationalized as any injury sustained in the previous year that was either severe enough to limit normal activities or not severe enough to limit normal activities but was investigated or treated by a health professional. Specifically, we derived our injury measures from survey questions about repetitive strain injuries in the previous 12 months that were serious enough to limit normal activities (i.e. carpal tunnel syndrome, tennis elbow, tendonitis), injuries serious enough to limit daily activities for at least 24 hours after the injury occurred (i.e. a broken bone, a bad cut, a burn or a sprain) and injuries in the past 12 months that were treated by a health professional but did not limit normal activities. We determined intentionality based on whether the injury was the result of a fall and the type of activity that caused the injury.

"Intentional injury and motor vehicle collisions (MVCs)" resulted from one of the following known causes: being a driver or passenger in an on- or off-road motor vehicle, physical assault or intentionally self-inflicted injury. While interpersonal violence and self-inflicted injury are widely considered to be intentional, there is ongoing debate as to whether motor vehicle collisions should be considered intentional or unintentional. We have chosen to combine MVC with intentional injuries in recognition that these incidents are largely preventable and that someone is almost always at fault. Some examples of "unintentional injuries" captured in the dataset are falls, overexertion or strenuous movement, unintentional contact with a sharp object or hot substance, injuries resulting from extreme weather or natural disasters, those sustained during leisure sports or physical activity, and repetitive strain injuries. We could not categorize some injuries as either intentional or unintentional, in which case they were counted as neither, but were included in the overall injury category.

* The user guide for the 2017 CCHS lists the response rates for children (aged 12–18) and adults (aged 19 and older) in Canada and each province but does not provide a response rate for our study population (aged 12–19).

Correlates

Key injury correlates that were examined were age (12–13, 14–16, 17–19 years), sex (male, female), income (low, middle, high), employment status (yes, no), presence of mood disorder(s) (yes, no), presence of anxiety disorder(s) (yes, no), cigarette consumption (yes, no) and binge drinking (yes, no).

Income was measured as total household income before taxes and deductions in the previous year, divided into terciles (low [≤ CAD 72 736]; medium [CAD 72 737–CAD 132 226]; high [≥ CAD 132 227]). A member of the household was asked to provide income information for underage respondents (aged 12–17 years) in recognition that young people may not know this information. The person who provided income information was asked for consent to link their data with tax records as a means of validation.

Employment status was classified into employed (employed in a business, self-employed or working in a family business, irrespective of pay) or not employed. All respondents aged 12 to 14 years were listed as "unemployed" because this age group is not legally able to work.

Mood disorders (such as depression, bipolar disorder, mania and dysthymia) and anxiety disorders (such as phobias, obsessive-compulsive disorders and panic disorders) were limited to those that had been diagnosed by a health care professional and had lasted or were expected to last six months or longer.

Smoking was defined as having smoked any cigarettes in the past 30 days. Binge drinking was defined as the consumption of five or more (males) or four or more (females) alcoholic drinks on one occasion during the previous year.

Data analysis

Prevalence estimates of overall injury (including those without cause information), intentional injury and MVCs and unintentional injury were calculated for the provinces combined ("pooled analysis") and individually. Cross-tabulation was used to determine injury prevalence across key correlates. Sample weights were used in all analyses. Accordingly, prevalence estimates are reported with a 95% confidence interval (CI). Logistic regression was used to assess whether differences in injury prevalence across correlates were statistically significant ($p < 0.05$). We created categories for all missing data to avoid losing any data from the analytical sample; however, these estimates have been suppressed in the tables presented here. As a condition of accessing confidential microdata through the Atlantic Research Data Centre, all cells with fewer than 15 cases in unweighted analyses were suppressed to avoid divulging potentially identifiable information. Analyses were conducted using Stata 15.[21]

Results

Injury prevalence by location

The prevalence of self-reported injuries in the previous year varied widely by type and location. The pooled (all provinces) point estimate for overall injury was 31%, and most provinces ranged from 28% (N.S.) to 33% (N.L.). However, Sask. was an outlier, where an estimated 41% of youth reported sustaining an injury in the previous year. Most injuries were unintentional, with a pooled prevalence of 27%, and most provinces ranged from 24% (Que.) to 28% (Alta.). Again, Sask. was an outlier at 36%. An estimated 1% of adolescents experienced an intentional injury/MVC in southern Canada. We only provide estimates for pooled analyses because most provincial estimates could not be published due to low cell counts.

Key correlates of injury prevalence

The number of significant correlations between correlates and prevalence rates varied widely by location, ranging from zero in N.L. to 11 in Ont., and 18 for all pooled analyses. Generally, there were fewer significant correlations in provinces with smaller (n < 300) sample sizes; in these cases, calculations may have been underpowered. Prevalence estimates were only reported for significant correlations for the pooled analyses for the sake of brevity. Full results can be found in Tables 1 to 3.

Overall injury prevalence across correlates

Table 1 shows the overall injury prevalence. Females had significantly lower injury rates in pooled analyses (females: 27.4%, 95% CI: 24.9%–30.2%; males: 35.0%, 32.1%–38.0%), and in B.C., Alta. and Que. Income exhibited a significant gradient association in pooled analyses and in Ont., and high-income household adolescents had significantly higher injury rates in N.S. and P.E.I., but middle-income household adolescents did not differ significantly. Adolescents from high-income households (34.4%, 30.7%–38.2%) and middle-income households (32.4%, 29.1%–35.7%) had a significantly higher overall injury rate relative to their low-income peers (27.6%, 24.4%–31.1%) in pooled analyses. Being employed was significantly correlated with a lower injury rate in Alta. Adolescents with mood disorders in Ont. had significantly higher overall injury prevalence. Likewise, adolescents with anxiety disorders had a significantly higher injury prevalence in Ont. and N.B. Cigarette use was significantly correlated with higher injury prevalence in pooled analyses (consumers: 45.2%, 36.3%–54.4%; abstainers: 30.7%, 28.7%–32.8%) and in Ont., while binge drinking was significantly correlated in pooled analyses (consumers: 39.6%, 35.2%–44.0%; abstainers: 28.6% (26.3%–31.0%), and in B.C. and Ont. There was no significant correlation between overall injury prevalence and age.

Unintentional injury prevalence across correlates

Unintentional injury rates are presented in Table 2. Saskatchewanians aged 17 to 19 years had significantly greater unintentional injury prevalence than those aged 12 to 13 years. Females had significantly lower unintentional injury rates in pooled analyses, in B.C. and in Que. Pooled analyses (highest tercile: 28.0%, 24.8%–31.5%; lowest tercile: 24.1%, 21.0%–27.6%) and N.S. exhibited significantly higher unintentional injury rates among the highest tercile of income, compared to the lowest (middle tercile was not significantly different). Being employed in Alta. and having an anxiety disorder in N.B. were significantly associated with greater unintentional injury risk. Smoking cigarettes was significantly correlated with unintentional injury risk in pooled analyses (consumption: 39.9%, 31.0%–49.5%; abstinence: 25.7%, 23.9%–27.7%), and in Ont. and Que. Binge drinking was significantly associated with increased unintentional injury in pooled analyses (consumption: 34.1%, 29.9%–38.4%); abstinence: 23.7%, 21.6%–25.9%), and in B.C., Man., Ont., Que. and N.B. There was no significant correlation between unintentional injury prevalence and mood disorders.

TABLE 1
Overall injury prevalence (%) among Canadians aged 12 to 19[a] years, weighted (prevalence and 95% CI), CCHS 2017

	Canada (n = 5366)	British Columbia (n = 620[a])	Alberta (n = 540[a])	Saskatchewan (n = 195[a])	Manitoba (n = 237[a])	Ontario (n = 1310[a])	Quebec (n = 907[a])	New Brunswick (n = 162[a])	Nova Scotia (n = 172[a])	Prince Edward Island (n = 92[a])	Newfoundland and Labrador (n = 160[a])
Overall	31.4 (29.4–33.5)	30.7 (25.9–36.0)	32.0 (27.5–36.8)	41.4 (32.8–50.5)	28.8 (21.8–37.0)	32.0 (28.4–36.0)	29.7 (26.1–33.5)	29.3 (21.1–39.1)	28.2 (21.2–36.4)	29.6 (21.5–39.3)	32.6 (23.2–43.7)
Age (years)											
12–13	31.1 (27.6–34.9)	26.5 (18.8–35.8)	33.6 (25.4–43.0)	27.1 (16.9–40.4)	24.2 (13.4–39.6)	34.1 (27.4–41.5)	28.5 (22.5–35.4)	29.1 (17.7–43.9)	37.4 (25.0–51.7)	35.6 (20.2–54.6)	24.8 (13.4–41.3)
14–16	32.4 (29.4–35.6)	33.1 (25.8–41.3)	38.1 (30.8–46.0)	43.1 (30.2–57.1)	27.6 (17.9–40.1)	30.4 (24.9–36.4)	32.6 (26.8–39.0)	27.1 (17.3–39.9)	29.0 (19.5–40.8)	25.4 (15.3–39.1)	39.1 (27.3–52.4)
17–19	30.7 (27.2–34.4)	31.4 (23.0–41.3)	25.3 (18.6–33.5)	49.3 (32.4–66.4)	32.8 (20.3–48.5)	32.2 (25.9–39.3)	27.5 (21.6–34.3)	31.8 (15.9–53.4)	20.9 (10.5–37.1)	31.4 (15.7–52.9)	28.7 (10.5–58.2)
Sex											
Male	35.0 (32.1–38.0)	36.9 (29.9–69.5)	35.3 (28.7–42.6)	44.3 (31.9–57.5)	35.5 (25.1–47.4)	35.5 (30.1–41.2)	33.4 (28.3–38.9)	27.2 (17.9–39.2)	27.1 (17.8–39.0)	33.7 (21.8–48.1)	29.8 (19.5–42.7)
Female	27.4 (24.9–30.2)*	24.7 (18.7–31.7)*	28.6 (23.0–35.0)*	38.3 (27.1–50.9)	21.2 (13.5–31.8)	28.1 (23.4–33.5)	25.4 (20.8–30.3)*	31.6 (19.0–47.6)	29.5 (20.0–41.0)	25.3 (15.4–38.5)	35.3 (20.9–53.0)
Income											
Low	27.6 (24.4–31.1)	33.0 (24.8–42.3)	28.6 (20.6–38.2)	33.6 (20.4–50.0)	26.4 (16.3–39.8)	25.4 (19.9–31.8)	29.6 (23.7–36.4)	23.0 (12.9–37.5)	21.0 (12.2–33.5)	14.3 (6.5–28.6)	23.3 (13.3–37.5)
Middle	32.4 (29.1–35.7)*	34.9 (26.9–43.7)	32.3 (24.0–41.9)	46.0 (31.1–61.7)	18.4 (10.5–30.1)	35.3 (29.2–42.0)*	26.8 (21.6–32.6)	34.5 (19.8–52.8)	30.4 (20.3–42.7)	31.2 (18.4–47.9)	29.0 (16.7– 45.3)
High	34.4 (30.7–38.2)*	24.0 (16.8–33.0)	33.7 (27.4–40.5)	43.4 (29.7–58.2)	44.1 (29.5–59.8)	36.1 (29.4–43.4)*	32.7 (26.2–40.0)	29.4 (17.8– 44.6)	41.5 (25.7–59.3)*	50.4 (31.3–69.5)*	42.3 (25.6– 61.4)
Employment											
No	30.6 (28.3–32.9)	30.3 (25.1–36.0)	35.1 (29.6–41.0)	43.9 (34.4–53.9)	27.4 (19.5–37.1)	30.2 (26.1–34.7)	27.6 (23.6–32.0)	30.8 (22.6–40.4)	26.2 (19.2–24.7)	32.4 (22.8–43.7)	29.9 (21.6–39.8)
Yes	33.7 (29.8–37.9)	31.9 (22.0–43.8)	23.4 (17.1–31.2)*	31.8 (17.1–51.3)	31.5 (19.0–47.5)	38.2 (30.8–46.1)	34.8 (27.7–42.7)	25.4 (8.7–55.9)	32.1 (16.8–52.3)	22.6 (10.7–43.0)	42.2 (17.1–72.1)
Mood disorder											
No	31.1 (29.1–33.2)	29.9 (25.0–35.3)	32.4 (27.7–37.5)	42.2 (33.3–51.6)	28.7 (21.4–37.3)	31.5 (27.7–35.6)	29.6 (26.0–33.5)	—	—	—	—
Yes	37.0 (29.6–45.1)	38.6 (19.7–61.7)	26.6 (15.7–41.4)	22.6 (8.0–49.4)	31.3 (14.2–55.7)	46.0 (32.3–60.4)*	33.0 (15.4–57.3)	—	—	—	—
Anxiety disorder											
No	31.0 (29.0–33.2)	31.0 (26.0–36.4)	31.7 (27.0–36.9)	42.6 (33.4–52.4)	28.7 (21.4–37.4)	31.5 (27.6 –35.6)	29.4 (25.8–33.4)	23.6 (16.8 –32.0)	27.5 (20.2–36.3)	—	—
Yes	35.9 (29.1–43.2)	27.4 (13.5–47.7)	32.8 (21.0–47.4)	34.4 (14.3–62.2)	31.3 (14.2–55.7)	40.7 (28.1–54.7)*	33.1 (20.6–48.6)	61.5 (34.5– 82.9)*	31.5 (14.9–54.7)	—	—

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TABLE 1 (continued)
Overall injury prevalence (%) among Canadians aged 12 to 19[a] years, weighted (prevalence and 95% CI), CCHS 2017

	Canada (n = 5366)	British Columbia (n = 620[a])	Alberta (n = 540[a])	Saskatchewan (n = 195[a])	Manitoba (n = 237[a])	Ontario (n = 1310[a])	Quebec (n = 907[a])	New Brunswick (n = 162[a])	Nova Scotia (n = 172[a])	Prince Edward Island (n = 92[a])	Newfoundland and Labrador (n = 160[a])
Cigarette use											
No	30.7 (28.7–32.8)	30.4 (25.4–35.8)	31.2 (26.7–36.2)	40.7 (31.9–49.7)	29.2 (21.9–37.7)	31.1 (27.4–35.1)	28.6 (25.0–32.6)	—	—	—	—
Yes	45.2 (36.3–54.4)*	39.6 (20.3–62.9)	45.5 (26.5–66.0)	51.4 (18.1–83.5)	21.0 (7.3–47.1)	53.3 (36.0–69.9)*	42.0 (28.6–56.8)	—	—	—	—
Binge drinking											
No	28.6 (26.3–31.0)	25.3 (20.3–31.1)	32.1 (26.8–39.9)	38.6 (29.5–48.6)	23.2 (16.3–32.0)	29.3 (25.1–33.8)	26.4 (22.0–31.3)	26.2 (18.7–35.3)	29.8 (22.2–38.7)	27.7 (18.9–38.7)	31.7 (23.0–41.9)
Yes	39.6 (35.2–44.0)*	52.6 (40.3–64.6)*	32.2 (23.8–41.8)	54.5 (32.1–75.2)	46.9 (29.5–65.1)	40.9 (32.2–50.2)*	34.3 (27.9–41.3)	48.8 (25.0–73.2)	20.4 (8.3–41.9)	30.1 (14.5–52.2)	41.0 (14.6–73.9)

Abbreviation: CCHS, Canadian Community Health Survey.

Note: "—" denotes that estimates have been suppressed due to small cell count.

[a] Canada data include respondents aged 12 to 19, but provincial-level CCHS data include only ages 12 to 18, since data for age 19 was suppressed due to small cell counts. We provide the number of respondents aged 12 to 18 years in each province, which is publicly available.

* Statistically significantly different odds of injury ($p < 0.05$).

TABLE 2
Unintentional injury prevalence (%) among Canadians aged 12 to 19[a] years, weighted (prevalence and 95% CI), CCHS 2017

	Canada (n = 5366)	British Columbia (n = 620[a])	Alberta (n = 540[a])	Saskatchewan (n = 195[a])	Manitoba (n = 237[a])	Ontario (n = 1310[a])	Quebec (n = 907[a])	New Brunswick (n = 162[a])	Nova Scotia (n = 172[a])	Prince Edward Island (n = 92[a])	Newfoundland and Labrador (n = 160[a])
Overall	26.5 (24.6–28.4)	25.7 (24.6–28.4)	28.0 (23.8–32.7)	36.4 (28.1–45.5)	25.2 (18.3–33.5)	27.1 (23.7–30.8)	23.8 (20.6–27.3)	24.8 (17.0–34.7)	24.3 (17.9–32.2)	25.9 (18.3–35.4)	27.5 (18.4–38.9)
Age (years)											
12–13	26.2 (22.8–29.8)	23.3 (16.1–32.5)	30.5 (22.6–39.8)	22.1 (12.9–35.4)	21.5 (11.1–37.5)	29.1 (22.7–36.4)	21.4 (16.4–27.3)	20.0 (11.1–33.4)	33.0 (21.3–47.3)	31.7 (17.3–50.8)	20.6 (10.7–36.2)
14–16	28.0 (25.0–31.1)	26.0 (19.7–33.6)	32.4 (25.5–40.2)	39.2 (26.6–53.4)	23.9 (14.7–36.5)	27.8 (22.4–33.9)	26.6 (21.1–33.0)	22.6 (13.5–35.3)	26.1 (17.0–38.0)	23.7 (13.9–37.3)	31.3 (20.4–44.7)
17–19	25.3 (22.2–28.7)	27.0 (19.1–36.7)	22.4 (16.0–30.6)	43.3 (27.5–60.5)*	28.7 (16.6–44.8)	25.4 (20.0–31.6)	22.5 (17.5–28.5)	30.4 (14.8–52.4)	16.4 (7.7–31.6)	24.2 (10.8–45.7)	26.7 (8.9–57.6)
Sex											
Male	29.9 (27.2–32.7)	33.0 (26.1–40.6)	31.5 (25.2–38.7)	39.4 (27.5–52.8)	31.9 (21.7–44.2)	29.8 (24.9–35.2)	27.1 (22.6–32.0)	23.9 (15.1–35.6)	23.7 (15.2–35.0)	28.1 (17.2–42.4)	24.4 (15.2–36.6)
Female	22.7 (20.3–25.3)*	18.6 (13.8–24.7)*	24.6 (19.3–30.7)	33.1 (22.6–45.6)	17.5 (10.3–28.1)	24.0 (19.5–29.2)	19.9 (15.6–25.1)*	25.8 (13.8–42.9)	25.1 (16.3–36.5)	23.6 (14.1–36.7)	30.5 (16.4–49.6)

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TABLE 2 (continued)
Unintentional injury prevalence (%) among Canadians aged 12 to 19[a] years, weighted (prevalence and 95% CI), CCHS 2017

	Canada (n = 5366)	British Columbia (n = 620[a])	Alberta (n = 540[a])	Saskatchewan (n = 195[a])	Manitoba (n = 237[a])	Ontario (n = 1310[a])	Quebec (n = 907[a])	New Brunswick (n = 162[a])	Nova Scotia (n = 172[a])	Prince Edward Island (n = 92[a])	Newfoundland and Labrador (n = 160[a])
Income											
Low	24.1 (21.0–27.6)	27.8 (19.9–37.4)	25.4 (17.7–35.0)	31.4 (18.5–47.9)	20.7 (11.6–34.3)	23.7 (18.3–30.1)	24.0 (18.5–30.5)	18.5 (9.6– 32.8)	14.8 (8.0–25.6)	—	—
Middle	27.4 (24.3–30.6)	29.9 (22.4–38.7)	27.4 (19.5–37.0)	39.7 (25.1–56.4)	16.3 (8.8–28.1)	28.7 (23.0–35.1)	23.4 (18.6–29.0)	31.4 (17.1– 50.5)	30.4 (20.3–42.7)	—	—
High	28.0 (24.8– 31.5)*	19.2 (13.5–26.6)	30.0 (24.1–36.8)	37.5 (24.8–52.2)	40.8 (26.3–57.1)	29.2 (23.4–35.9)	23.8 (18.6–29.9)	22.6 (12.8– 36.8)	35.9 (20.7–54.6)*	—	—
Employment											
No	26.0 (23.9–28.3)	25.2 (20.4–30.6)	30.5 (25.2–36.3)	37.5 (28.2–47.8)	24.3 (16.6–34.1)	26.0 (22.0–30.4)	22.7 (19.1–26.8)	25.6 (18.0–35.0)	23.7 (17.0–32.1)	27.4 (18.8–38.5)	24.4 (16.9–33.9)
Yes	27.6 (24.2–31.4)	27.2 (18.1–38.8)	21.1 (15.1–28.8)*	30.9 (16.5–50.2)	27.0 (15.0–43.5)	30.8 (24.5–37.8)	26.2 (20.2–33.2)	23.0 (7.0–54.2)	25.9 (13.0–45.0)	22.6 (10.2–43.0)	38.4 (13.8–70.8)
Mood disorder											
No	26.3 (24.4–28.3)	24.9 (20.4–30.1)	28.9 (24.4–33.9)	—	27.9 (19.9–37.7)	26.8 (23.3–30.6)	23.5 (20.3–27.1)	—	—	—	—
Yes	30.0 (23.3–37.6)	32.8 (15.6–56.4)	18.0 (9.2–32.1)	—	17.3 (8.6–31.9)	35.7 (24.1–49.2)	31.9 (14.6–56.2)	—	—	—	—
Anxiety disorder											
No	26.2 (24.2–28.2)	25.8 (21.2–31.1)	27.8 (23.3–32.8)	37.3 (28.4–47.0)	25.0 (17.9–33.7)	26.8 (23.5–30.7)	23.6 (20.4–27.3)	18.4 (12.4–26.4)	23.3 (16.7–31.5)	—	—
Yes	30.0 (23.9–36.9)	23.7 (11.3–42.9)	28.9 (17.6–43.6)	31.5 (12.1–60.7)	30.0 (13.2–54.6)	32.2 (21.3–45.5)	25.6 (14.7–40.75)	60.9 (33.8– 82.5)*	29.9 (13.6– 53.5)	—	—
Cigarette use											
No	25.7 (23.9–27.7)	25.7 (21.1–30.9)	27.5 (23.1–32.3)	—	25.4 (18.3–34.0)	26.2 (22.8–29.9)	22.4 (19.3–26.0)	—	—	—	—
Yes	39.9 (31.0–49.5)*	26.5 (10.6–52.3)	38.5 (21.1–59.4)	—	21.0 (7.3–47.1)	47.8 (30.3–65.9)*	39.2 (26.0–54.1)*	—	—	—	—
Binge drinking											
No	23.7 (21.6–25.9)	20.6 (16.1–25.9)	28.0 (22.8–33.7)	33.4 (24.6–43.5)	19.6 (13.1–28.3)	24.5 (20.7–28.7)	20.2 (16.3–24.7)	20.0 (13.4–28.8)	25.5 (18.5–34.1)	25.2 (16.8–36.0)	25.1 (17.3–34.9)
Yes	34.1 (29.9–38.4)*	46.3 (34.1–58.9)*	28.2 (20.4–37.7)	49.7 (28.7–70.7)	43.5 (26.1–62.7)*	34.9 (26.7–44.2)*	27.8 (22.3–34.2)*	48.0 (24.3–72.7)*	19.4 (7.7–40.9)	26.3 (11.9–48.6)	39.8 (13.6–73.6)

Abbreviation: CCHS, Canadian Community Health Survey.

Note: "—" denotes that estimates have been suppressed due to small cell count.

[a] Canada data include respondents aged 12 to 19, but provincial-level CCHS data include only ages 12 to 18, since data for age 19 was suppressed due to small cell counts. We provide the number of respondents aged 12 to 18 years in each province, which is publicly available.

* Statistically significantly different odds of injury ($p < 0.05$).

TABLE 3
Intentional injury/MVC prevalence (%) among Canadians aged 12 to 19[a] years, weighted (prevalence and 95% CI), CCHS 2017

	Canada (n = 5366)
Overall	0.7 (0.5–1.0)
Age (years)	
12–13	0.19 (0.1–0.5)
14–16	0.5 (0.3–0.9)
17–19	1.3 (0.8–1.9)*
Sex	
Male	0.8 (0.5–1.3)
Female	0.6 (0.4–1.0)
Income	
Low	—
Middle	—
High	—
Employment	
No	0.4 (0.3–0.6)
Yes	1.5 (0.94–2.5)*
Mood disorder	
No	0.6 (0.4–0.9)
Yes	3.0 (1.5–5.8)*
Anxiety disorder	
No	0.6 (0.4–0.9)
Yes	1.6 (0.9–2.9)*
Cigarette use	
No	0.6 (0.4–0.8)
Yes	3.2 (1.4–7.3)*
Binge drinking	
No	0.5 (0.4–0.8)
Yes	1.3 (0.7–2.3)*

Abbreviations: CCHS, Canadian Community Health Survey; MVC, motor vehicle collision.

Note: "—" denotes that estimates have been suppressed due to small cell count.

[a] Canada data include respondents aged 12 to 19, but provincial-level CCHS data include only ages 12 to 18, since data for age 19 was suppressed due to small cell counts. We provide the number of respondents aged 12 to 18 years in each province, which is publicly available.

* Statistically significantly different odds of injury ($p < 0.05$).

Intentional injury/MVC prevalence across correlates

Table 3 provides prevalence estimates for intentional injury/MVC among Canadians 12 to 19 years. We were unable to publish intentional injury/MVC estimates for most locations or for income, due to low cell counts. Therefore, we only provide pooled estimates and have suppressed provincial analyses. Adolescents aged 17 to 19 years (1.3%, 0.8%–1.9%) had a significantly higher rate compared to those aged 12 to 13 years (0.19%, 0.1%–0.5%). Adolescents who were employed had significantly higher prevalence (employed: 1.5%, 0.9%–2.5%; not employed: 0.4%, 0.3%–0.6%), as did those with a mood disorder (disorder: 3.0%, 1.5%–5.8%; no disorder: 0.6%, 0.4%–0.9%), or an anxiety disorder (disorder: 1.6%, 0.9%–2.9%; no disorder: 0.6%, 0.4%–0.9%). Adolescents who smoked cigarettes (consumers: 3.2%, 1.4%–7.3%; abstainers: 0.6% (0.4%–0.8%) or partook in binge drinking (consumers: 1.3%, 0.7%–2.3%; abstainers: 0.5%, 0.4%–0.8%) had significantly higher rates. There was no significant correlation between intentional injury/MVC prevalence and sex.

Discussion

We calculated self-reported overall, unintentional and intentional/MVC injury prevalence in the past year among southern Canadians aged 12 to 19 years according to socioeconomic, mental health and substance use indicators. In pooled analyses, an estimated 31.4% (29.4%–33.5%) of adolescents reported sustaining an injury in the previous year, most of which were unintentional (26.5%, 24.6%–28.4%). Overall injury prevalence varied by location, with Alta., Sask., Ont. and N.L. reporting greater prevalence than pooled analyses and the other provinces reporting lower rates. Sask. far exceeded other provinces' overall and unintentional injury rates. Around 1% of adolescents sustained an intentional injury/MVC in the previous year. These rates are substantially greater than prevalence rates obtained from hospitalization data (DAD, indexed with ICD-10 codes).[22] This discrepancy was expected because our rates include injuries that did not meet the threshold for medical attention (or did not receive treatment for other reasons, such as neglect or lack of access).

Previous research also found that adolescents in Sask. face a substantially greater injury burden than in other provinces; Sask. has the highest rate of child and adolescent hospitalization for injuries.[23,24] This province requires targeted interventions. Unfortunately, our study found few significant associations between injury rates and key correlates among adolescents in Sask., due to low sample size, meaning that future investigation is needed to identify subpopulations that may benefit from targeted interventions.

Echoing previous research on Canadian adolescents,[7,9] this study found that substance use is associated with injury prevalence. Of particular note, our research updates and corroborates previous research by Mo and colleagues,[7] based on the 2000/01 CCHS, that found similar significant correlations between household income, smoking status, binge drinking and sex with injury prevalence.

Other findings include that employment status was rarely significantly associated with injury prevalence, which is surprising considering previous research found that most Canadian adolescents are injured either at work or during sports and leisure activities.[7] Intentional injury/MVC was more prevalent among employed adolescents (pooled analysis). However, in Alta., there was a significantly *lower* prevalence of overall and unintentional injury among employed adolescents.

The scarcity of significant associations is surprising, given that previous research found key differences in injury by sex, age, socioeconomic status,[8,9] employment status[25] and mental health status.[10] However, many previous studies have drawn on administrative health records rather than self-report, which may indicate that sex, age and socioeconomic status are more strongly linked to injuries severe enough to warrant hospital care rather than to the overall injury rate. Overall, the results of this study suggest that injury prevention interventions aimed at binge drinking are likely to be effective in reducing adolescent injury burden.[11]

The general inconsistency in associations between covariates and injury prevalence across provinces—except for binge drinking—demonstrates that context matters. Our findings suggest that any attempts to reduce injury prevalence should be customized to the province in which they will be implemented, because there are few common correlates among provinces.

Future research should investigate how provincial (or more granular) contexts impact injury rates. An important first step would be to create a comparative evaluation of provincial programs and policies aimed at limiting the harms associated with adolescent binge drinking.

Injury prevention programs have been shown to reduce injury rates in Canada,[26,27] but the patchwork of injury prevention schemes contributes to the variation in injury rates.[28] The long-term morbidity and quality of life impact of adolescent injuries is another promising direction for future research, as it may affirm the need to invest in injury prevention.[18] Some injury prevention interventions have been proven to both ease injury burden and provide net savings (i.e. by preventing hospitalizations or lost productivity); however, more information is needed to support the economic basis for injury prevention.[5,29,30]

Strengths and limitations

Our study boasts a rich, representative dataset. By drawing on self-reported data that were representative of the adolescent population (aged 12–19 years) in southern Canada, we shed light on the "hidden figure" of adolescent injury, which is not captured by administrative datasets. The dataset also allowed us to examine injury prevalence by 10 socioeconomic, mental health and substance use variables, which are also mainly missing from administrative datasets.

However, this dataset also presented some limitations. Most notably, the small sample sizes in some provinces prohibited us from examining some known correlates of injury prevalence—such as indigeneity[31,32]—and may have caused some associations to be underpowered. Just as small sample sizes in provinces prohibited confident estimates, the large sample sizes in Ont. and Que. may have resulted in statistically significant correlations that have little practical significance.

The CCHS survey also prohibited causal conclusions due to its cross-sectional nature. Although the exclusion of territorial residents from our analyses is unfortunate, previous research using self-reported data found no significant difference between overall injury rates between Canadian provinces and the territories, although the prevalence of some specific injury types differed.[33] The CCHS target population covers about 98% of Canadians aged 12 years and older,[19] but the exclusion of on-reserve Indigenous populations and those in the military is unfortunate because previous research shows that these populations have higher risk of injury than the general population.[31,34,35] Furthermore, this study does not consider fatal injuries. As fatalities are beyond the scope of our research question, we consider this as an omission rather than a limitation. However, it is important to recognize that many Canadians who die young do so because of injury. Unintentional injuries are the leading cause of death for Canadians aged 10 to 19 years. Intentional injuries are also responsible for a high proportion of deaths: suicide is the third and second most common cause of death, and homicide is the tenth and the fifth most common cause of death, among those aged 10 to 14 years and 15 to 19 years, respectively.[36]

Conclusion

This study complements an existing body of research on injury burden among Canadian adolescents, which often relies on hospitalization and fatality data. By using self-reported data from a representative dataset, this study sheds light on the "hidden figure" of adolescent injury. Just under a third of Canadians aged 12 to 19 years living in the 10 provinces experienced an injury that was serious enough to limit their normal activities or require medical care in the previous year; most of those injuries were unintentional. Policies and programs aimed at reducing binge drinking among Canadian adolescents are likely to lower injury rates.

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Conflicts of interest

None to declare.

Authors' contributions and statement

MA conceptualized and designed the study, with help from GE. Data analysis was conducted by NS with assistance from MA, AR and GI. The first draft of the manuscript was written by KM and all authors commented on previous versions of the manuscript.

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