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Understanding clusters of risk factors across different environmental and social contexts for the prediction of injuries among Canadian youth

K. Russell [a,b,h,*], C. Davison [c,d,e,h], N. King [c], I. Pike [f,g,h], W. Pickett [c,e,h]

[a] Department of Pediatrics and Child Health, University of Manitoba, Winnipeg, MB, Canada
[b] Children's Hospital Research Institute of Manitoba, Winnipeg, MB, Canada
[c] Department of Public Health Sciences, Queen's University, Kingston, ON, Canada
[d] Kingston General Hospital, Kingston, ON, Canada
[e] Department of Emergency Medicine, Queen's University, Kingston, ON, Canada
[f] Department of Pediatrics, University of British Columbia, Vancouver, BC, Canada
[g] BC Injury Research and Prevention Unit, Child and Family Research Institute, BC Children's Hospital, Vancouver, BC, Canada
[h] CIHR Team in Child and Youth Injury Prevention, Vancouver, BC, Canada

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ABSTRACT

Background: Among Canadian youth, injury is the most common reason for presentation to the emergency department. Youth who commonly engage in multiple risk-taking behaviours are at greater risk for injury, but is it unknown if this phenomenon is more pronounced in different contexts. We aimed to study relationships between risk-taking behaviours and injury, and variations in such relationships between different environmental and social contexts, among youth in Canada.

Methods: Risk-taking behaviour and injury outcome data were collected from grade 9 to 10 students using the 2009–2010 (Cycle 6) of the Health Behaviour in School-Aged Children Survey (n = 10,429). Principal components analysis was used to identify clusters of risk-taking behaviours. Within each identified cluster, the degree of risk-taking was categorized into quartiles from lowest to highest engagement in the behaviours. Risk ratios with 95% confidence intervals were calculated to determine the association between the risk of any injury and the degree of risk-taking behaviour specific to the cluster. Clusters were then examined across home, school, neighbourhood and sport contexts.

Results: Four clusters of risk-taking behaviour were identified which were labelled as "gateway substance use", "hard drugs and weapons", "overt risk-taking", and "physical activity". Each cluster was related to injury occurrence in a graded fashion. Clusters of risk behaviour were most strongly associated with injuries sustained in neighbourhood settings, and expectedly, increasing physical activity behaviours were associated with increased risk of sport injuries and injuries occurring at school.

Conclusions: This study furthers understanding of clustered risk-taking phenomena that put youth at increasing levels of injury risk. Higher risks for injury and associated gradients were observed in less structured contexts such as neighbourhoods. In contrast, clustered physical activity behaviours were most related to school injury or sport injury and were more likely to be sustained in a supervised context. Understanding the clustered and cumulative nature of risk-behaviours, and how these vary by environmental and social context, helps to explain potential mechanisms of injury as well as modifiable factors that may be important avenues for intervention.

Introduction

The economic burden of injuries for all Canadian residents is an estimated $26.8 billion annually [1]. On a global scale injuries account for 70% of deaths among 5–19 year old children [2]. In a recent OECD report, Canada ranked 22nd out of 29 countries (with 29 representing the highest risk) for the occurrence of preventable childhood injuries and deaths [3]. In addition to the pain and

* Corresponding author at: University of Manitoba, Pediatrics and Child Health, 656 JBRC 715 McDermot Ave. Winnipeg, MB, Canada R3E 3P4.
Tel.: +1 204 480 1312; fax: +1 204 977 5691.
E-mail address: krussell@chrim.ca (K. Russell).

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suffering caused by childhood injury, injuries place a significant strain on families, communities, and healthcare systems. The first step to reducing this injury burden is to identify risk factors for their occurrence and understand how these may differ by context so targeted preventive strategies can be implemented [4,5]. In addition, preventing one risk-taking behaviour may simultaneously reduce the prevalence of other risk-taking behaviours due to the clustered, or synergistic, nature of risk-taking [6,7].

Risk factors for child injury include individual risk-taking or problem behaviours, many of which are modifiable or preventable [8]. These include for example, use of drugs and alcohol, physical fighting, or not wearing recommended safety equipment. Individuals who engage in one risk-taking behaviour are more likely to also perform other risk-taking behaviours. A dose-dependent response between engagement in increasing numbers of risk-taking behaviours and increased injury risk has been documented in Canadian [9,10] and international populations [11]. Defined clusters of risk-taking behaviour in youth have been identified, as previous studies have conceptually grouped clusters of risk-taking behaviours together [12].

In addition to behavioural determinants of injury, there are contextual, or environmental, factors that place youth at greater risk. Context may be important as youth spend their time in both controlled, supervised environments (e.g., schools, sports teams) but also search for independent, unstructured environments with peers, such as spending times in their neighbourhoods or staying in their house without parental supervision. These different contexts are influential on subsequent injury risk. For example, among Canadian grade 9–10 students, no relationship was demonstrated between multiple risk-taking behaviours and physical activity injuries occurring outside of school, yet associations were found for physical activity injuries occurring at school [13]. To date, no study has examined variations in the effects of clustered risk-taking on injury across the multiple contexts where youth spend their time. Therefore, after determining factor analytically derived clusters of risk-taking behaviours and their association with injury among Canadian youth enrolled in grades 9–10, our objective was to determine whether the effects of the identified clusters of risk-taking behaviours differed across various youth contexts.

Patients and methods

Data source and population

Health Behaviour in School-aged Children (HBSC) is an international study conducted in affiliation with the World Health Organization. The Canadian survey is managed by Queen's University in Kingston, Ontario. The sixth cycle of the survey was administered during the 2009–2010 school year to 26,078 Canadian students enrolled in grades 6–10. Four hundred and thirty-six schools were involved across eight provinces and three territories; all but Prince Edward Island and New Brunswick participated. Schools were selected purposefully in order to be representative by: province/territory, type of board (public or separate), urban through rural geography, language of instruction, and numbers of students in schools. Standardized population weights were generated to reflect the sampling criteria, and ensure that the full sample was representative nationally. The weights ranged from 0.02 to 3.65. The survey was not administered to schools situated on First Nation reserves, incarcerated youth, or those who were home schooled or attending private school. Because many risk-taking behaviours pertaining to drug and alcohol use are not asked of grade 6–8 students (age 12–14 years), only the grade 9–10 (age 14–16 years) students were included in this study (n = 10,261). Efforts to test the various items used in this survey for reliability and validity have been documented elsewhere [14–18].

Risk-taking behaviours

Students indicated how many times they had engaged in any of the following behaviours within the past 12 months: been drunk, binge drank, used cannabis, smoked cigarettes, used illicit drugs, misused prescription drugs, or engaged in physical fighting. These behaviours were grouped into categories (never, 1–2 times, more than twice). Students reported the age at which they first drank alcohol to intoxication, smoked cigarettes, used cannabis, or used other drugs. These too were categorized (younger than 14 years, 14 years or older, not applicable). Additional risk-taking behaviours included: having friends who carry weapons, cycling without a helmet, not using a helmet when riding an all-terrain vehicle, eating fast food, consuming energy drinks, being an impaired driver within the past 30 days, being a passenger of an impaired driver within the past 30 days, stealing, or skipping class and these were classified as never, sometimes, often/always. Participating in unprotected sex was dichotomized (yes or no). Based on weekly physical activity both in and out of school, students were classified as sedentary ($<$2 h), infrequently active (2–5.5 h), or frequently active ($\geq$5.5 h).

Injury outcomes and injury contexts

The primary outcome was any injury reported within the past 12 months that resulted in treatment by a doctor or nurse. Students who reported such injuries were then asked details about their "one most serious injury" in the last year. Serious injury was defined according to the modified Abbreviated Injury Score that was developed for the HBSC survey [19]. Serious injuries were those that required significant medical treatment (e.g., casts, stitches, surgery, or overnight admission to the hospital). Students' "one most serious injury" were also classified by context, with specific interest in injuries that occurred at: school, in a home or yard, in a neighbourhood, or while playing sports.

Potential confounders

Potential confounders that have been previously established as independent risk factors for injury were extracted. These included age [20,21], sex [22–24], perceived level of affluence compared to peers (well-off, average, not well-off) [25], immigration status (immigrated within 1–5 years, more than five years, born in Canada) [26,27], depressed (yes, no) [28], overall health status (high, average, low) [29], being physically bullied (often, sometimes, never) [30,31], living in a foster home (yes, no) [32,33], sedentary behaviour ($\geq$5 h per day, 3–4 h per day, $\leq$2 h per day) [34], and participation in organized sport (yes, no) [35].

Analysis

Principal components analysis–identifying clusters of risk-taking behaviours. A principal components analysis of the 25 available risk-taking behaviours was conducted using raw variances and covariances and varimax rotation [36]. Based on standard criteria (the Scree plot, eigenvalues values greater than one, and more than 5% of variance explained in a cluster) [37], four clusters of risk-taking behaviours were identified. Based on the type of risk-taking behaviours these contained, we called these clusters: "gateway substance use", "hard drugs and weapons", "overt risk-taking", and "physical activity". Individual risk-taking behaviours were removed if their factor loading was less than 0.40 [38]. For each of the four clusters, Cronbach's alpha was calculated to quantify the