

ADVANCES

Emergency department dispositions among 4100 youth injured by violence: a population-based study

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ABSTRACT

Objective: Concern about youth violence in Canada is growing. Because victims of violence are more likely to become future violent perpetrators, preventative interventions are often based out of inpatient units; however, the question of how often youth who have been injured due to violence are discharged from emergency departments (EDs), or whether there are opportunities for emergency healthcare workers to deliver violence prevention programs, is not known. The primary objectives of this study were to describe the frequency and patterns of violent injuries among youth, to determine how many injured youth are discharged directly from EDs and to estimate the proportion of injured youth who may benefit from ED-based intervention programs.

Methods: We conducted an observational study using a population-based database that records information on all ED visits in Ontario. We analyzed age, sex, cause of injury and disposition for all patients aged 12–19 years who presented to Toronto EDs with violent injuries during a 2-year period (April 2002 to March 2004).

Results: A total of 4100 patients aged 12–19 years visited Toronto EDs with violent injuries during the study period. Assault due to bodily force (in contrast to sharp objects, guns or other) was the most common injury mechanism, accounting for 48.7% of cases (95% confidence interval [CI] 47.1%–50.2%). The majority of patients (89.3%; 95% CI 88.3%–90.2%) were discharged directly from EDs, including 44% of gun-related injuries.

Conclusion: In Toronto, a large proportion (89.3%) of youth injured in violent incidents are discharged directly from EDs. There are opportunities to develop ED-based youth violence prevention initiatives.

Key words: youth, violence, emergency medicine, prevention, victim

RÉSUMÉ

Objectif : La violence chez les jeunes au Canada préoccupe de plus en plus. Comme les victimes de violence sont plus susceptibles de devenir eux-mêmes des gens violents par la suite, les interventions de prévention sont souvent basées dans les unités pour patients hospitalisés. On ne sait toutefois pas à quelle fréquence des jeunes blessés par violence reçoivent leur congé des services d'urgence ou s'il serait possible pour les intervenants des services d'urgence de dispenser des programmes de prévention de la violence. Cette étude visait principalement à décrire la fréquence et les tendances des blessures par violence chez les jeunes, à déterminer combien de jeunes ainsi blessés obtiennent leur congé directement des services d'urgence et à estimer le pourcentage des jeunes blessés qui pourraient bénéficier d'un programme d'intervention offert dans des services d'urgence.

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Méthodes : Nous avons réalisé une étude d'observation fondée sur une base de données représentative où l'on consigne de l'information sur toutes les visites effectuées à l'urgence en Ontario. Nous avons analysé les données en fonction de l'âge, du sexe, de la cause de la blessure et de son issue pour tous les patients âgés de 12 à 19 ans qui se sont présentés aux services d'urgence à Toronto avec une blessure causée par un acte de violence au cours d'une période de deux ans (avril 2002 à mars 2004).

Résultats : Au total, 4100 patients âgés de 12 à 19 ans ont visité les services d'urgence de Toronto pour une blessure par violence au cours de la période étudiée. L'agression avec violence physique (comparativement aux objets tranchants, aux armes à feu ou autres) était le mécanisme traumatisant le plus répandu, à l'origine de 48,7 % des cas (intervalle de confiance [IC] à 95 %, 47,1 %–50,2 %). La majorité des patients (89,3 %; IC à 95 %, 88,3 %–90,2 %) ont reçu leur congé directement du service d'urgence, y compris 44 % qui avaient subi une blessure par arme à feu.

Conclusion : À Toronto, un pourcentage important (89,3 %) des jeunes blessés au cours d'incidents de violence reçoivent leur congé directement des services d'urgence. Il serait possible d'élaborer des programmes de prévention de la violence chez les jeunes et de les offrir dans les services d'urgence.

Introduction

Canadians are increasingly concerned with youth violence,¹ particularly in urban centres. Overall crime, including youth crime, has decreased in Canada over the last decade, but serious violent youth crime increased in 2005, and homicide increased by 47% from 2004.² This demonstrates an ongoing need for youth violence prevention efforts. Victims of violence are more likely to become repeat victims, and are often perpetrators of future violence.^{3,4} These people often present to emergency departments (EDs), meaning there are opportunities for emergency physicians to intervene with these youth in an effort to reduce the risk of recurrence.

Emergency physicians have led successful injury prevention programs — notably in the areas of domestic violence and impaired driving.^{5–7} Injury control literature shows that passive protection through legislation, regulation and bio-engineering (e.g., airbags) can change injury patterns.^{8,9} In addition to our advocacy role, physicians have the important, albeit difficult, challenge of recognizing the “teachable moment” and attempting to effect behavioural change. American emergency physicians have documented success in modifying violent youth behaviours by linking patients with appropriate intervention programs; these efforts have led to promising reductions in attitudes toward violence and in injury rates.^{10–13}

Little has been published about youth violence prevention efforts in Canadian EDs. The primary objectives of this study were to describe the frequency and patterns of violent injuries among youth, to determine how many injured youth are discharged directly from EDs and to estimate the proportion of injured youth who may benefit from ED-based intervention programs.

Methods

Study design

We completed a population-based observational study using data from the National Ambulatory Care Reporting System (NACRS) database, compiled by the Canadian Institute for Health Information. This database includes demographic, clinical, administrative, financial and service-specific data from all Ontario EDs. All NACRS data are gathered from the ED chart by trained data-entry staff at each site. No identifiable information for individuals or institutions was provided from the database. This project was approved by the Sunnybrook and Women's College Health Science Centre Research Ethics Board without requiring individual informed consent.

Settings and patients

We studied all Greater Toronto Area EDs as well as full-service hospital-based urgent care centres that offered laboratory and diagnostic imaging services. We included 13 hospitals with 19 sites, comprising about half a million annual patient visits.¹⁴ Youth, patients aged 12–19 years as defined by the Public Health Agency of Canada,¹⁵ were included if they visited 1 of the sites between April 1, 2002 and March 31, 2004, and exhibited an external cause of injury due to violence.

Measurements and outcomes

We used International Classification of Disease (ICD-10CA) External Cause of Injury codes to classify the cause of injury (Table 1). Sex, disposition and patient referrals were documented, and postal code data were used for targeting potential interventions. Population data were obtained from 2001 census data using the Greater Toronto

Area federal electoral district data for calculating incidence rates.¹⁶

Data analysis

Data were analyzed using Stata (Intercooled Stata Version 9.2, StataCorp LP, College Station, Tex.), and 95% confidence intervals (CIs) were reported for all point estimates. Proportions were compared using the 2-sample test of proportion, and *p* values were reported.

Results

During the study period, 4100 eligible youth attended a Greater Toronto Area ED after violent injury, accounting for 2.6% of ED patients in this age range. Table 2 shows that 72.8% of the victims were male (95% CI 71.4%–74.1%). Patients aged 17 and 18 years had the highest incidence rates with 69 and 74 per 10 000 youth injured annually, respectively (Fig. 1).

Bodily force was the most common cause of injury, accounting for 48.7% of injuries (95% CI 47.1%–50.2%), while knives or other sharp objects accounted for 27.7% of injuries (95% CI 26.3%–29.1%). Sexual assaults accounted for 6% of injuries, and the specific cause of injury was not reported in 9.9% of cases. Table 2 shows that, despite growing concern over firearms, gunshot wounds accounted for only 1.5% of injuries (95% CI 1.1%–1.9%). Table 3 shows a statistically significant increase in gun-

related injuries between the first and second year of the study, from 24 (1.0% of injuries) to 37 (2.1% of injuries) patients ($z = -2.86$, $p < 0.01$). Additionally, there was a statistically significant increase of 5.2% ($z = -3.70$, $p < 0.001$) in proportions of those injured by knives or sharp objects between the first and second year.

Males were more likely than females to suffer blunt

Table 2. Characteristics of study patients

Characteristic	Total <i>n</i> = 4100, no. (and %)	95% confidence intervals
Sex		
Male	2984 (72.8)	71.4%–74.1%
Female	1116 (27.2)	25.9%–28.6%
Cause		
Bodily force	1995 (48.7)	47.1%–50.2%
Knives or sharp objects	1136 (27.7)	26.3%–29.1%
Other*	407 (9.9)	9.0%–10.8%
Blunt object	255 (6.2)	5.5%–7.0%
Sexual assault	246 (6.0)	5.3%–6.7%
Guns	61 (1.5)	1.1%–1.9%
Visit disposition, <i>n</i> = 4092†		
Discharged	3652 (89.3)	88.3%–90.2%
Admitted or transferred	246 (6.0)	5.3%–6.7%
LWBS or LAMA	190 (4.6)	4.0%–5.3%
Died	4 (0.1)	0.0%–0.2%

LWBS = left without being seen; LAMA = left against medical advice.

*"Other" includes 90% unspecified injury; see Table 1.

†*n* < 4100 due to missing data in 8 cases for this variable.

Table 1. Injury category with ICD-10CA codes and descriptions

Category	Code	Description
Blunt object	Y00	Assault (homicide) by blunt object
Bodily force	Y04	Assault (homicide) by bodily force
Gun	X93	Assault (homicide) by handgun discharge
	X94	Assault (homicide) by rifle, shotgun and larger firearm discharge
	X95	Assault (homicide) by other and unspecified firearm discharge
	W32	Handgun discharge
	W33	Rifle, shotgun or larger firearm discharge
	W34	Discharge from other and unspecified firearms
Knives or sharp objects	X99	Assault (homicide) by sharp object
	W26	Contact with knife, sword or dagger
Sexual assault	Y05	Sexual assault (homicide) by bodily force
Other*	Y08	Assault (homicide) by other specified means
	Y09	Assault (homicide) by unspecified means

ICD-10CA = International Classification of Diseases.

*90% of the "Other" category was due to Y08 and Y09. The remaining 10% of "Other" injuries were coded: X85, assault (homicide) by drugs, medicaments and biological substances; X86, assault (homicide) by corrosive substance; X87, assault (homicide) by pesticides; X88, assault (homicide) by gases and vapors; X89, assault (homicide) by other specified chemicals and noxious substances; X90, assault (homicide) by unspecified chemical or noxious substance; X91, assault (homicide) by hanging, strangulation and suffocation; X92, assault (homicide) by drowning and submersion; X96, assault (homicide) by explosive material; X97, assault (homicide) by smoke, fire and flames; X98, assault (homicide) by steam, hot vapors and hot objects; Y01, assault (homicide) by pushing from high place; Y02, assault (homicide) by pushing or placing victim before moving object; Y03, assault (homicide) by crashing of motor vehicle; Y08, assault (homicide) by other specified means; Y09, assault (homicide) by unspecified means. The injuries in these categories all had events numbering under 8 in total, making statistical inferences inappropriate in their own category.

object injuries (7.1% v. 3.9%; $p < 0.001$), bodily force injuries (52.2% v. 39.3%; $p < 0.001$), knives or sharp object injuries (29.0% v. 24.3%; $p < 0.05$) and gun-related injuries (1.8% v. 0.5%; $p < 0.05$); whereas, females were more likely to be victims of sexual assault (21.3% v. 0.3%; $p < 0.001$).

The majority of injury victims (89.3%; 95% CI 88.3%–90.2%) were discharged directly from the ED (Table 2). Only 6.0% (95% CI 5.3%–6.7%) were admitted or transferred to another facility, while 4.6% (95% CI 4.0%–5.3%) left without being seen or left against medical advice. Four patients (0.1%) died in the ED as a result of their injuries. Of those injured by guns, 44.3% (95% CI 31.6%–56.8%) were discharged directly, 49.1% (95% CI 36.5%–61.8%) were admitted or transferred to another facility and 3 patients (4.9%; 95% CI, –0.6% to 10.4%) died. Of those injured by knives or sharp objects, 86.2% (95% CI 84.2%–88.2%) were discharged directly, 9.3% (95% CI 7.6%–11.0%) were admitted or transferred to another facility and 1 patient (0.09%, 95% CI –0.08% to 0.3%) died.

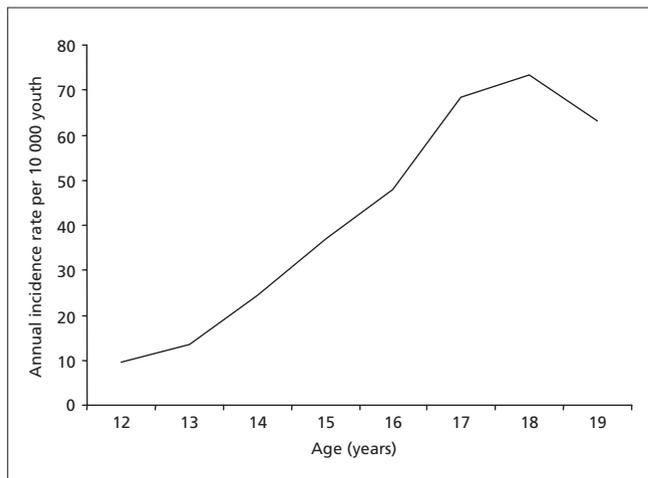


Fig. 1. Annual incidence rate per 10 000 youth by year of age.

Discussion

Youth violence is a major national concern.¹ Ours is the first Canadian study to document youth violence patterns, demonstrating that 89.3% of injured youth who attended EDs and urgent care centres were discharged directly from these environments. This suggests that ED staff were the only health professionals involved with these youth immediately following the violent experience and that the ED may be an optimal location for violence prevention interventions.

This study's low admission rate for youth injured by violence is consistent with that of other countries. A Boston pediatric ED surveillance study demonstrated that only 6.4% of patients requiring treatment for violence-related injuries required hospital admission.¹⁷ In an Israeli study of youth, 84% were discharged directly from the ED.¹⁸ This high percentage of direct ED discharges highlights the fact that ED staff are often the only health care workers who treat patients after violent injuries. As a result, EDs in other countries are developing ED-based youth violence intervention programs. In Oakland, Calif., the "Caught in the Crossfire" program aims to intervene with youth in the ED.¹³ Case workers, referred to as "intervention specialists," arrive within 1 hour of a patient's ED presentation and offer long-term case management. A retrospective case-control evaluation comparing hospitalized youth enrolled in the program with hospitalized youth not enrolled in the program showed a 70% relative risk reduction in re-arrest and a 60% relative risk reduction in criminal involvement.¹³ EDs in Philadelphia have implemented similar programs. A Chicago ED cohort study to test the effectiveness of a case-management based program found 81% of the treatment group, compared with 10% of the control group, made use of linked services, mainly for education, job readiness and mental health.¹⁰

While emergency physicians must take a leadership role

Table 3. Year over year trend analysis of cause of injury

Cause	No. of cases (and %)			Difference from 2002–2003 to 2003–2004, %	p value*
	Total n = 4100	2002–2003 n = 2351	2003–2004 n = 1749		
Bodily force	1995 (48.7)	1177 (50.1)	818 (46.8)	-3.3	< 0.05
Knives or sharp object	1136 (27.7)	599 (25.5)	537 (30.7)	+5.2	< 0.01
Other	407 (9.9)	271 (11.5)	136 (7.8)	-3.7	< 0.01
Blunt object	255 (6.2)	151 (6.4)	104 (5.9)	-0.4	0.53
Sexual assault	246 (6.0)	129 (5.5)	117 (6.7)	+1.2	0.11
Guns	61 (1.5)	24 (1.0)	37 (2.1)	+1.1	< 0.01

*2-sample test of proportion.

in linking at-risk youth to preventative programs, they should not be responsible for program delivery. The skills required to provide such interventions would be difficult for emergency physicians to obtain and maintain given the small volume of violently injured youth the average emergency physician sees. Overcrowding and the already stretched resources of Canadian EDs raise potential concerns for the implementation of ED behavioural interventions. Linking patients to outside programs similar to "Caught in the Crossfire" will likely place the least burden on limited ED resources while fulfilling emergency physicians' patient advocate responsibilities. Emergency physicians should assume leadership in establishing protocols for referral by any ED personnel (e.g., nurses and social workers) and consulting services (e.g., trauma).

Despite concerns about increasing gun violence among youth, our data show that most injuries in Toronto continue to be due to bodily force. Given the small but statistically significant increase in firearm injuries in the second year of our study, it will be important to see if this becomes a trend; however, we can make no further conclusions to this, as this study was not designed to detect time trends. This issue should be addressed in a future time-series analysis.

Limitations

This study has several limitations. Administrative data have inherent limitations, thus it is impossible to determine from the data set whether the perpetrator was another youth or an adult. The effect of violence inflicted by parents or other adults will likely have a different effect on youth, necessitating different postinjury interventions. Data for the NACRS data set are coded from emergency physician and nurse chart records; therefore, the data may underestimate the number of violent injuries if they were not recorded as such on the charts. This method of data collection may also account for the 9.9% of violent injuries recorded as having unspecified causes, as physicians or nurses may not have recorded more specific information. Additionally, NACRS data are coded and collected by different people at each site. There is likely some variability as to how some injuries are coded. The Canadian Institute for Health Information has a data quality enhancement program that maintains uniformity.¹⁹ Each record in our data set was unidentifiable and unable to be linked to other records due to privacy legislation. Therefore, we were unable to determine multiple visits. Our data includes only injuries that resulted in ED visits. Of particular concern are victims of violence who did not survive long enough to present to an ED. Those who chose to seek help from other health care professionals or

received no health care assistance at all were also not included in this database. Additionally, our data was collected in one urban centre and therefore may not be generalizable to rural populations; however, 80% of Canadians now live in urban areas.²⁰

The majority (89.3%) of youth victims of violence are discharged directly from EDs. These victims often become repeat victims or future perpetrators of violence. Therefore, opportunities exist for the development of ED youth violence prevention initiatives.^{3,4} This study's authors are currently completing a systematic review of ED youth violence interventions. While intervention programs have shown promise in the United States, we cannot make the assumption that the same programs will work in Canada. A formative community evaluation and subsequent development and evaluation of an ED-based youth violence prevention program is planned. This future research will be necessary in Canada to help EDs determine what role they can play in effectively reducing youth violence in our communities.

Conclusion

A large proportion (89.3%) of youth who are injured by violence and who visit Toronto EDs are discharged directly from EDs. Opportunities exist for development of ED-based youth violence prevention initiatives.

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