ORIGINAL ARTICLES

Youth injury data in the Canadian Hospitals Injury Reporting and Prevention Program: do they represent the Canadian experience?

William Pickett, Robert J Brison, Susan G Mackenzie, Michael Garner, Matthew A King, T Lawson Greenberg, William F Boyce

Abstract

***Objective*—Injuries to Canadian youth (11–15 years) identified from a population based health survey (World Health Organization—Health Behaviour in School-Aged Children Survey, or WHO-HBSC) were compared with youth injuries from a national, emergency department based surveillance system. Comparisons focused on external causes of injury, and examined whether similar rankings of injury patterns and hence priorities for intervention were identified by the different systems.**

***Setting*—The Canadian version of the WHO-HBSC was conducted in 1998. The Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) is the national, emergency room based, surveillance program. Two hospitals involved in CHIRPP collectively provide population based data for Kingston, Ontario.**

***Method*—Numbers of injuries selected for study varied by data source: WHO-HBSC (n=3673); CHIRPP (n=20 133); Kingston CHIRPP (n=1944). WHO-HBSC and Kingston CHIRPP records were coded according to four variables in the draft International Classification of External Causes of Injury. Existing CHIRPP codes were available to compare Kingston and other CHIRPP data by five variables. Males and females in the three datasets were ranked according to the external causes. Data classified by source and sex were compared using Spearman's rank correlation statistic.**

***Results*—Rank orders of four variables describing external causes were remarkably similar between the WHO-HBSC and Kingston CHIRPP ($\rho>0.78$ $p<0.004$) for mechanism, object, location, and activity). The Kingston and other CHIRPP data were also similar ($\rho>0.87$; $p<0.001$) for the variables available to describe external causes of injury (including intent).**

***Conclusion*—The two subsets of the CHIRPP data and the WHO-HBSC data identified similar priorities for injury prevention among young people. These findings indicate that CHIRPP may be representative of general youth injury patterns in Canada. Our study provides a novel and practical model for the validation of injury surveillance programs.**

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Department of Emergency Medicine and Department of Community Health and Epidemiology, Queen's University
W Pickett
R J Brison

Laboratory Centre for Disease Control, Health Canada
S G Mackenzie
T L Greenberg

Department of Emergency Medicine, Queen's University
M Garner

Social Program Evaluation Group, Faculty of Education, Queen's University
M A King

Department of Community Health and Epidemiology and Social Program Evaluation Group, Faculty of Education, Queen's University
W F Boyce

Correspondence to:
Dr William Pickett, Assistant Professor, Department of Emergency Medicine, Queen's University, Angada 3, Kingston General Hospital, 76 Stuart St, Kingston, Ontario, Canada K7L 2V7 (e-mail: PickettW@post.queensu.ca)

Injury surveillance is the ongoing and systematic collection, analysis, interpretation, and dissemination of injury information.[1] National injury surveillance systems have been developed in many different countries,[2–10] and all of these produce data that are meant to identify priorities for prevention and assist in the development of prevention strategies. Examples of established injury surveillance systems include: mortality registries,[11 12] administrative records from hospitals,[3 13] or workers' compensation systems,[14 15] and consumer product injury systems such as the United States National Electronic Injury Surveillance System.[8] Emergency department based surveillance systems include the Basic Routine Injury Surveillance System in Australia,[3] and in Canada, the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP).[2]

The CHIRPP program was established in 1990, and contains information on emergency room visits for the treatment of injuries presenting to Canada's 10 paediatric hospitals and to six general hospitals. CHIRPP data from two general hospitals in Kingston, Ontario (a component of the Kingston and Region Injury Surveillance Program) are believed to be population based for injuries seen at emergency departments.[16–18] A point often raised in discussion of CHIRPP is that its injury data may not represent the Canadian experience. Bases for such comments are that the participating hospitals are not representative of Canadian hospitals with emergency rooms, most of the participating hospitals do not see all of the injuries seen at emergency rooms in their respective communities, and injuries seen in emergency might not be similar to other, medically treated injuries. While the

Table 1 Samples of injury records available for analysis

Demographic factor	*Population based survey (Canadian WHO-HBSC)*	*Regional injury surveillance program (Kingston CHIRPP)*	*National injury surveillance program (CHIRPP)*
No (%) records			
Total	3673 (100)	1944 (100)	20133 (100)
Males	1914 (52.1)	1149 (59.1)	12571 (62.4)
Females	1759 (47.9)	795 (40.9)	7562 (37.6)
Mean (SD) age			
Total	13.70 (1.38)	13.49 (1.46)	13.38 (1.40)
Males	13.70 (1.38)	13.54 (1.45)	13.44 (1.39)
Females	13.70 (1.39)	13.43 (1.46)	13.31 (1.41)

CHIRPP data from Kingston may be population based with respect to injuries seen within emergency, the extent to which patterns of injury observed in Kingston can be generalized to other Canadian communities has not, to date, been examined. The comparability of population based data (such as the subset of CHIRPP data from Kingston) with CHIRPP data has also not been established.

One approach to assessing the comparability of the two subsets of CHIRPP data is to compare their respective patterns of injury with those from a true population based data source. The World Health Organization Health Behaviour in School-Aged Children (WHO-HBSC) survey is one such source. This is a collaborative, cross national research project involving countries in Northern Europe, the Middle East, and North America.[19] Large and representative samples of youth (ages 11,13, and 15) are drawn from school based settings in each of the countries. Canada has participated in the WHO-HBSC on three occasions, most recently in 1997–98. In the latest iteration, a series of questions was asked about injuries that occurred during the 12 months before survey, and were treated by a doctor or nurse.

In 1998, the WHO also released a draft coding system called the International Classification of External Causes of Injury (ICECI).[20] This system is meant to eventually become a companion to the standard International Classification of Diseases. It allows researchers to code injury records, from a variety of sources, according to several variables that describe external causes of injury. We applied the ICECI to records of injury contained in the Canadian version of the WHO-HBSC (1997–98), as well as records from the two Kingston hospitals in the CHIRPP program (1997). Our aims were to describe external causes of injury among Canadian youth by the major variables contained in the ICECI; and, to assess and compare the priorities for intervention that arose from both data sources. Next, we went on to compare the Kingston youth injury data with CHIRPP data for youth presenting to the other participating Canadian hospitals. Comparisons still focused on external causes of injury, but this time using coding according to the CHIRPP data protocol.[21]

Our basic hypothesis was that the same patterns of injury would emerge from our analyses of the two subsets of CHIRPP data (from Kingston and the other centres) and the population based survey (WHO-HBSC). If so, this would be strong evidence in support of using CHIRPP data to frame injury prevention strategies for Canadian youth.

Methods

CHIRPP

CHIRPP is a computerized injury surveillance program that operates in the emergency rooms of selected Canadian hospitals.[2] The dataset is maintained in Ottawa at the Child Injury Division of the Bureau of Reproductive and Child Health at the Laboratory Centre for Disease Control, a Directorate of the Health Protection Branch of Health Canada. CHIRPP began operation in the 10 Canadian pediatric hospitals in 1990, and has since been expanded to

Table 2 Comparison of Canadian WHO-HBSC and Kingston CHIRPP injury records by external cause: mechanism of injury, by sex

		Population based survey (Canadian WHO-HBSC)		*Regional injury surveillance program (Kingston CHIRPP)*		*Spearman's correlation between data sources:ρ (p value)*
ICECI codes	*Mechanism of injury*	*Records (%)*	*Rank*	*Records (%)*	*Rank*	
Males		(n=3673)		(n=1944)		
A1	Contact with blunt object	22.7	2	25.2	2	0.964 (<0.001)
A2	Application of bodily force	15.2	3	14.8	3	
A3	Crushing	1.9	8	3.3	7	
A4	Falling, stumbling, jumping	29.9	1	34.8	1	
A8–A9	Blunt force: unspecified contact	3.4	7	1.3	8	
C1–9	Penetrating force	7.9	5	11.3	4	
G1–G3	Thermal, radiant mechanism	0.9	9	1.0	9	
J1–J9	Threats to breathing	0.2	11	0.2	11	
N1–N9	Poisoning by chemicals	0.5	10	0.3	10	
P1–P9	Physical over-exertion	6.9	6	4.1	5	
U1–U9	Other/unspecified	10.4	4	3.7	6	
Females		(n=1759)		(n=795)		
A1	Contact with blunt object	14.9	2	21.8	2	0.782 (0.004)
A2	Application of bodily force	10.1	5	10.1	3	
A3	Crushing	2.3	9	4.0	6	
A4	Falling, stumbling, jumping	36.6	1	42.9	1	
A8–A9	Blunt force: unspecified contact	3.1	7	0	11	
C1–9	Penetrating force	7.5	6	8.3	4	
G1–G3	Thermal, radiant mechanism	2.4	8	1.3	8	
J1–J9	Threats to breathing	0.2	11	0.4	10	
N1–N9	Poisoning by chemicals	0.7	10	0.5	9	
P1–P9	Physical over-exertion	11.8	3	7.3	5	
U1–U9	Other/unspecified	10.5	4	3.5	7	
Spearman's correlation between sexes: ρ (p value)		0.927 (<0.001)		0.936 (<0.001)		

Table 3 Comparison of Canadian WHO-HBSC and Kingston CHIRPP injury records by external cause: object or substance producing injury (leading 20 categories), by sex

ICECI codes	Object/substance	Population based survey (Canadian WHO-HBSC)		Regional injury surveillance program (Kingston CHIRPP)		Spearman's correlation between data sources: ρ (p value)
		Records (%)	Rank	Records (%)	Rank	
Males		(n=1914)		(n=1149		
A1–A99	Infant's or child's product	0.3	16.5	0.9	12	0.910 (<0.001)
B1–B99	Furnishing	0.8	11	1.8	10	
C1–C99	Household appliances	1.7	7	2.8	9	
E19	Pedal cycle (bicycle)	0.4	14	0.6	15	
E21–E99	Other land (transport) vehicle	2.5	6	3.0	8	
F9–F99	Special purpose vehicle	0.3	16.5	0.1	20	
G9–G99	Water craft	0.2	19.5	0.3	17.5	
I1–I99	Sporting equipment	10.8	3	17.5	2	
J1–J99	Tool, machine, apparatus	1.1	10	3.4	7	
K29–K69	Animal	0.6	12	1.7	11	
K7–K19	Plant	1.3	9	0.8	13.5	
NA*	Self	3.2	5	3.5	6	
K71,K75	Person (other than self)	11.2	2	15.1	3	
L23–L99	Ground surface/conformations	16.5	1	24.6	1	
N1–N99	Food and drink	0.2	19.5	0.2	19	
O21–O99	Personal use item	0.3	16.5	0.8	13.5	
R1–R99	Building, component, or fitting	6.7	4	12.9	4	
S9–S99	Material	1.4	8	4.5	5	
T8–T99	Weapon	0.5	13	0.3	17.5	
Z19–Z98	Miscellaneous object, substance	0.3	16.5	0.4	16	
Females		(n=1759)		(n=795)		
A1–A99	Infant's or child's product	0.3	15	1.0	14	0.887 (<0.001)
B1–B99	Furnishing	0.8	10	2.1	10	
C1–C99	Household appliances	1.8	7	2.6	8	
E19	Pedal cycle (bicycle)	0.4	11	0.4	18	
E21–E99	Other land (transport) vehicle	2.5	6	3.0	7	
F9–F99	Special purpose vehicle	0.3	15	0.3	19	
G9–G99	Water craft	0.1	19.5	0.6	16	
I1–I99	Sporting equipment	5.3	5	12.8	3	
J1–J99	Tool, machine, apparatus	1.0	9	1.6	11	
K29–K69	Animal	0.3	15	2.4	9	
K7–K19	Plant	0.3	15	0.8	15	
NA*	Self	6.0	4	7.4	5	
K71,K75	Person (other than self)	7.2	3	10.6	4	
L23–L99	Ground surface/conformations	16.9	1	25.2	1	
N1–N99	Food and drink	0.3	15	1.1	12.5	
O21–O99	Personal use item	0.3	15	1.1	12.5	
R1–R99	Building, component, or fitting	10.3	2	18.5	2	
S9–S99	Material	1.3	8	3.1	6	
T8–T99	Weapon	0.1	19.5	0.0	20	
Z19–Z98	Miscellaneous object, substance	0.3	15	0.5	17	
Spearman's correlation between sexes: ρ (p value)		0.894 (<0.001)		0.925 (<0.001)		

*At the time of this work the draft ICECI did not include a code for self.

include six general hospitals. Information on the circumstances in which injuries occur is generally provided by the patient, or accompanying adult, who completes a one page self administered CHIRPP questionnaire. Clinical information is provided by the attending physician or abstracted from the patient's medical chart.

Records of all injuries occurring from 1 January to 31 December 1997 to children aged 11–15 years were identified and abstracted from the CHIRPP dataset. Further inclusion criteria were: (1) valid sex code for the injured person and (2) received any form of treatment in the emergency room. In order to increase the validity of subsequent comparisons, records from the two hospitals in Kingston, Ontario were excluded from the main CHIRPP sample. The inclusion criteria were met by 20 133 records, which are referred to as CHIRPP records in this report.

KINGSTON CHIRPP SITE

The Kingston General and Hotel Dieu hospitals house the two emergency departments in Kingston, Ontario. Since 1993, injury data from these hospitals have been collected and entered into the national CHIRPP database. The Kingston subset of the database provides a regional database that is a component of the Kingston and Region Injury Surveillance Program. The Kingston site is unique in the CHIRPP program because of its complete community coverage (which does not occur at other CHIRPP centres) in combination with the intensive efforts made to obtain records for all injuries seen.

Sampling criteria for the two Kingston hospitals were the same as for other CHIRPP data, except that the search was limited to the Hotel Dieu and Kingston General hospitals in Kingston. The inclusion criteria were met by 1944 records, which are referred to as Kingston CHIRPP records in this report.

WHO-HBSC SURVEY

The 1997–98 WHO-HBSC involved study of a sample of Canadian students from grades 6–10, with a systematic over sampling of grades 6, 8, and 10. A cluster sample design was used with the school class being the basic cluster. The sample was designed so that the distribution of the students in the sample reflected the distribution of Canadians in the selected grades. The sample from each province represented its distributions of community type, geographic location, language of instruction, and religious affiliation. The sample was drawn

Table 4 Comparison of Canadian WHO-HBSC and Kingston CHIRPP injury records by external cause: activity when injured, by sex

ICECI codes	Activity	Population based survey (Canadian WHO-HBSC)		Regional injury surveillance program (Kingston CHIRPP)		Spearman's correlation between data sources: ρ (p value)
		Records (%)	Rank	Records (%)	Rank	
Males		(n=1914)		(n=1149)		
1,2	Paid or unpaid work	4.9	5	6.8	5	0.979 (<0.001)
3	Travelling	22.6	2	17.3	2	
4,5	Sports: organized or informal	49.8	1	48.1	1	
6	Leisure	8.9	4	12.4	3	
7	Education	2.0	6	5.3	6	
8	Health care	0	9	0	8.5	
9	Vital activity	1.4	7	0.4	7	
10	Being taken care of	0.1	8	0	8.5	
11–19	Other/unspecified	10.3	3	9.6	4	
Females		(n=1759)		(n=795)		
1,2	Paid or unpaid work	6.7	5	4.8	5	0.979 (<0.001)
3	Travelling	25.5	2	24.4	2	
4,5	Sports: organized or informal	41.4	1	40.1	1	
6	Leisure	10.1	4	13.7	3	
7	Education	3.1	6	4.0	6	
8	Health care	0.1	8	0	8.5	
9	Vital activity	1.6	7	1.3	7	
10	Being taken care of	0	9	0	8.5	
11–19	Other/unspecified	11.7	3	11.7	4	
Spearman's correlation between sexes: ρ (p value)		0.983 (<0.001)		1.000 (<0.001)		

from 95% of the eligible students. Youth in private and special needs schools, street youth, and the incarcerated were excluded.

The Canadian version of the WHO-HBSC asked questions about injuries that occurred during the "12 months prior to the survey, and were treated by a doctor or nurse".[19] If more than one medically treated injury was reported, respondents were asked to describe the most "serious" of these injury events. The format and scope of these questions is described elsewhere.[19 22] They included questions that allowed the injuries to be classified according to several variables that describe the external cause.

A total of 11 416 young people participated in the Canadian version of the 1997–98 WHO-HBSC. Of these, 4144 reported at least one injury for the previous 12 months, treated by a doctor or nurse. Records were included in the present analysis if: (1) the age of the respondent was 11–15 years and (2) their sex was indicated. These criteria were met by 3673 records.

ICECI

The ICECI was released in a draft format at the Fourth World Conference on Injury Prevention and Control in Amsterdam, May 1998.[20] Variables describing external causes of injury that are considered in this system include: mechanism of injury, object or substance producing injury, activity when injured, place of occurrence, and intent. The first hierarchical level of the ICECI coding structure was applied to all eligible youth injury reports in the Kingston CHIRPP and WHO-HBSC data sets. Research assistants performed the coding, cleaning, and data entry. Methodological issues that arose during these procedures are documented elsewhere.[22]

ANALYSIS

Descriptive statistics (cross tabulations, means, SDs) were used to characterize all samples by their age and sex distribution. The records were then divided into groups according to sample and sex. For the WHO-HBSC and Kingston CHIRPP samples, records in each of the four groups were classified and ranked according to leading external causes using the four ICECI variables. Because respondents to the WHO-HBSC questionnaire were not asked to describe whether or not their injuries were intentional, this variable was excluded from the main study comparisons. Non-parametric statistics (Spearman's rank correlation)[23] were used to quantify the strength and statistical significance of correlations between the rankings. For each variable, ranks were compared: (1) between the two samples within each sex and then (2) between the two sexes within each sample.

The Kingston and other CHIRPP comparisons followed an analogous plan of analysis, except that existing CHIRPP variables[22] were used in place of those from the new ICECI system. The following CHIRPP variables were used: mechanism, mechanism factor (object), context (activity), location (place of occurrence), and intent of injury. It was not feasible to recode the 20 133 records in the CHIRPP sample according to the ICECI because of limited resources.

Results

Table 1 describes the study samples by age and sex. Of the injuries reported to the Kingston CHIRPP system, 59.1% were to males, compared with 62.4% in the CHIRPP sample, and 52.1% within the WHO-HBSC (χ^2 = 141.3; 2 df; p<0.001). The three samples had essentially equivalent age distributions.

WHO-HBSC V KINGSTON CHIRPP

Table 2 shows leading mechanisms of injury in both samples by sex. The rank order of these mechanisms was remarkably consistent between the Kingston CHIRPP and WHO-HBSC injury samples for both sexes (ρ=0.78; p=0.004). Males and females also had similar

Table 5 Comparison of Canadian WHO-HBSC and Kingston CHIRPP injury records by external cause: place of occurrence, by sex

ICECI codes	*Location*	*Population based survey (Canadian WHO-HBSC)*		*Regional injury surveillance program (Kingston CHIRPP)*		*Spearman's correlation between data sources: ρ (p value)*
		Records (%)	*Rank*	*Records (%)*	*Rank*	
Males		(n=1914)		(n=1149)		
1	Home	20.9	2	21.2	2	0.912 (<0.001)
2	Institutional area	0.3	10.5	0.2	11	
3	Medical service area	0.6	8	0	12.5	
4	School, educational area	18.3	3	12.4	3	
5	Sports and athletics area	35.9	1	40.1	1	
6	Transport area: street/highway	13.3	4	8.9	4	
7	Transport area: other	0.3	10.5	0.7	8	
8	Industrial and construction area	0.1	13	0	12.5	
9	Farm	0.5	9	0.5	9	
10	Recreational/cultural area/building	2.5	6.5	4.2	6	
11	Commercial area	0.2	12	0.3	10	
12	Countryside	2.5	6.5	2.7	7	
13, 14*	Other/unspecified	4.6	5	8.9	5	
Females		(n=1759)		(n=795)		
1	Home	28.0	1	26.2	2	0.881 (<0.001)
2	Institutional area	0.4	10	0.8	8.5	
3	Medical service area	0.6	8.5	0.1	12.5	
4	School, educational area	24.9	3	11.1	3	
5	Sports and athletics area	26.9	2	32.8	1	
6	Transport area: street/highway	10.3	4	7.0	6	
7	Transport area: other	0.6	8.5	0.4	11	
8	Industrial and construction area	0	13	0.1	12.5	
9	Farm	0.2	12	0.5	10	
10	Recreational/cultural area/building	2.3	6	8.1	5	
11	Commercial area	0.3	11	0.8	8.5	
12	Countryside	1.1	7	1.8	7	
13, 14*	Other/unspecified	4.3	5	10.4	4	
Spearman's correlation between sexes: ρ (p value)		0.953 (<0.001)		0.939 (<0.001)		

*These codes have been replaced with 18,19 in a more recent version of the ICECI.

distributions of injury mechanisms within each of the samples: WHO-HBSC, $\rho=0.93$; $p<0.001$ and Kingston CHIRPP, $\rho=0.94$; $p<0.001$). Objects or substances producing injury are summarized in table 3. Again, the rank orders of these objects were remarkably consistent (for both sexes) between the two samples. This was also found to be the case for activity when injured (table 4) and place of occurrence (table 5). For each of object/substance, activity and location, the rank order of the different external causes of injury were very similar between the sexes (regardless of sample: $\rho>0.89$; $p<0.001$).

KINGSTON CHIRPP V CHIRPP

Table 6 summarizes the correlation analysis that compared the rank order of external causes (coded according to the CHIRPP data protocol[22]) within the Kingston CHIRPP and other CHIRPP datasets. The rank orders of the five variables that describe external cause (including intent) were remarkably consistent between the two datasets.

Discussion

Injury surveillance conducted at a community level is of fundamental importance to the planning of effective interventions.[24 25] As a public health tool, ongoing surveillance can suggest true priorities for injury prevention, groups to be targeted within a population, and prevention strategies within these groups. The existence of a population based injury surveillance program can ensure that priorities chosen for public policy/action are based upon objective data and common and/or severe injuries, as opposed to reactive agendas that can follow more isolated events. Surveillance programs can also be useful in the ongoing evaluation of injury prevention programs over time.

The CHIRPP program provides one possible national model of injury surveillance. Canada has invested considerable energy and resources towards the ongoing surveillance of emergency department treated injuries in sentinel hospitals across the country. The present analysis addresses a question that is often raised in discussion of the national program: whether CHIRPP data represent the Canadian experience.[2] The focus of this study was limited to youth injuries because of the predominance of children's hospitals in the CHIRPP system, and the fact that comparable, national survey data that could be used to identify and rank common injury patterns were available from the WHO-HBSC.

The results suggest that the patterns of injury occurrence and the priorities for youth injury prevention that emerged from the WHO-HBSC were similar to those identified within the Kingston CHIRPP system. This was true for the four variables examined to describe external cause, both for males and females. Priorities for youth injury prevention that emerged from the Kingston CHIRPP data were also extremely similar to those from the

Table 6 Correlations between external causes of injury recorded in Kingston CHIRPP and CHIRPP datasets: five variables that describe external cause, by sex

	Spearman's correlation between data sources: ρ (p value)				
	Mechanism	*Mechanism factor (object)*	*Context (activity)*	*Location (place of occurrence)*	*Intent*
Males	0.957 (<0.001)	0.960 (<0.001)	0.976 (<0.001)	0.968 (<0.001)	0.988 (<0.001)
Females	0.912 (<0.001)	0.868 (<0.001)	0.976 (<0.001)	0.918 (<0.001)	0.964 (<0.001)

national, CHIRPP dataset. Although the CHIRPP and WHO-HBSC comparison was made in an indirect manner, it is reasonable to assume that CHIRPP data can be used to establish national priorities. Furthermore, CHIRPP data may be used to guide injury prevention programming at the community level unless there is reason to believe that local youth risk exposure differs from the national pattern.

The major priorities identified included falls and sports injuries (as indicated by the large numbers of injuries associated with sporting equipment, and that occurred in the context of sports or in sports areas). The relatively high frequencies of objects that were ground/surface conformations are consistent with these types of injury. More in-depth analyses are required to further specify common circumstances, and then suggest actual preventive interventions for these specific patterns of injury.

A second comment about CHIRPP and other emergency room based injury surveillance programs was addressed indirectly by this analysis. This is that emergency department treated injuries may be dissimilar to other medically treated injuries, especially those seen by family physicians and other health care providers in non-hospital settings. The WHO-HBSC documented all injuries that received medical treatment by a doctor or nurse, whether or not they went to an emergency department.[19] The distribution of these injuries according to the source of medical treatment was not documented in a systematic, valid manner. Priorities for prevention that emerged from these data were, however, the same as those identified within the Kingston CHIRPP and CHIRPP emergency department data. Patterns of youth injury seen in the emergency department, and the priorities for intervention that emerge from such data, may therefore be adequate for policy making to prevent medically treated youth injuries in general.

Although priorities identified from the patterns of information were similar between datasets, the analysis is limited in that rates of emergency room treated injuries could not be calculated for the other CHIRPP sites. In addition, the WHO-HBSC collected detailed information on only one injury per respondent and did not document the source of treatment. We were therefore unable to calculate rates in all three datasets, and it was also not possible to build injury pyramids (ratios of deaths: hospitalizations: emergency room visits: other injuries) that describe the full magnitude of the youth injury problem in Canada. Unlike the WHO-HBSC, the CHIRPP datasets can contain information on more than one injury per person. However, repeat visits to emergency for treatment of different injuries were small in practice (7.1% of Kingston CHIRPP and 4.8% of CHIRPP records), and there were minimal differences between the single and multiple visit records with respect to age, sex, and all external causes of injury. The WHO-HBSC is also limited in that recall for medically treated injuries, whether reported by the youth themselves[26] or their parents[27] is not always accurate over a one year period. Accuracy of reporting tends to be better for injuries that require time lost from school or significant medical intervention.[26] This tendency may have minimized any differences between the WHO-HBSC and CHIRPP samples, and made it more difficult to detect subtle differences in injury patterns between them.

Information on the intent of injuries could not be completely analyzed in this study because the WHO-HBSC questionnaire did not directly ask about intent. However, we suspect that had responses been available, we should have observed more discrepancies for this variable than for those that were studied. One reason for this is the different sources of the information. Self reports were the only source for the WHO-HBSC study but CHIRPP data on intent could be provided either by the patient (or accompanying adult) or the physician.

Comparison of the Kingston CHIRPP and CHIRPP data on intent revealed no differences in the ranks of the values. Nevertheless, there are reasons for caution in using these data on intent: self reports do not always reflect the true intent, particularly for abuse and intentionally self inflicted injuries; physicians may be reluctant to record suspected abuse; and the assessment reported on CHIRPP forms is made in the emergency room before a thorough investigation of the circumstances can be completed. Validation studies are needed to assess the completeness and accuracy of data about intentional injuries in Canadian emergency rooms and other contexts.

This project served the dual purposes of performing the study presented in this paper, and exposing our research staff to the new ICECI system. The analysis was limited due to the fact that the three datasets were not coded according to a single coding system for external cause of injury. Since simultaneous coding of the data according to both the ICECI and CHIRPP codes was not feasible due to cost restraints, we were required to make indirect comparisons between the WHO-HBSC and CHIRPP datasets. In addition, it is important to note that the CHIRPP reports had higher proportions of male injuries when compared with the WHO-HBSC ($p<0.001$). There are a number of possible explanations for this observation, including the possibility that injuries experienced by males are, on average, of higher severity and require emergency medical care more often than female injuries. It is also possible that females and females tend to seek medical attention from different sources for certain types of injury. The present analysis was not designed to determine the exact reasons for these differences, and the above explanations should be treated as hypotheses as opposed to factual conclusions.

Implications for prevention

In summary, this analysis compared patterns of youth injury by external cause in three Canadian datasets, one of which (the WHO-HBSC) was known to be population based. Patterns of injury observed in the Kingston and

other CHIRPP subsets of the community based emergency room surveillance system were remarkably similar to those seen in the WHO-HBSC. The analysis offers a novel but important model for the validation of existing injury surveillance systems. This approach to validation could be used in settings where there is simultaneous access to injury surveillance data that is similar to CHIRPP, and population based data from surveys such as the WHO-HBSC.

It is important to note that CHIRPP is not a population based injury surveillance system, nor was it ever intended to provide estimates of the burden of injury among Canadian children and youth. That information is available routinely from mortality and hospitalization data sources. CHIRPP's strength has always been its wealth of information on the circumstances in which injuries occur, information that, for most types of injuries, cannot be obtained elsewhere. However, the value of the information has been questioned because CHIRPP is not population based. The results of this study represent important new evidence generated to address such questions, and the findings should be of value to the national CHIRPP program, and to injury control initiatives in Canada and other countries.

This study provides evidence that information on the circumstances in which injuries occur obtained from a non-representative group of emergency departments is equivalent to that obtained from a random sample of the population. Youth injury patterns obtained from CHIRPP data represent general injury patterns observed among Canadian youth, including those that are not treated in emergency department setting. This adds credibility to the idea that surveillance in sentinel, Canadian hospitals is of value for the planning of, and setting priorities for, national injury prevention programs and for guiding community level injury intervention programming in the absence of local surveillance data. It also suggests that each community does not need its own complex surveillance system to obtain data on circumstances in which injuries occur. In conclusion, the results strongly support the use of injury surveillance in sentinel hospitals following the CHIRPP model. The approach to injury surveillance is within the scope of many communities and countries that might not be able to develop more complex and expensive surveillance options.

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