

# Emergency Department Presentations for Self-harm Among Ontario Youth

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## ABSTRACT

**OBJECTIVES:** Self-harm is an important public health issue among youth, including as a major risk factor for suicide (a leading cause of death in this age group). This study used population-based emergency department data to describe clinical and demographic characteristics of emergency department presentations for self-harm among youth (12-17 year-olds) in the province of Ontario, Canada.

**METHODS:** Administrative data capturing every emergency department visit in Ontario between April 1, 2002 and March 31, 2009 were used to identify and describe self-harm presentations.

**RESULTS:** Over the 7-year period between 2002/03 and 2008/09, there were 16,835 self-harm presentations by 12,907 youth. Two thirds of self-harm presentations were self-poisonings (almost always with medicinal agents), followed by self-cutting, which accounted for about one quarter. Incidence rates were higher in girls than boys, increased with age, were inversely related to neighbourhood income and were highest in rural areas. Self-harm accounted for about 1 in 100 emergency department presentations by youth, but also a disproportionate number of presentations triaged as high acuity or admitted to hospital (about 1 in 20).

**CONCLUSION:** Self-harm is an important public health issue, requiring a comprehensive approach to prevention. Ontario has useful data with which to study emergency department presentations for self-harm, and the similarities between self-harm presentations among Ontario youth and those reported from the United States and Europe suggest generalizability of results between populations. Further research is needed to address the reasons for the geographic differences in frequency of self-harm.

**KEY WORDS:** Self-injurious behavior; emergency medical services; child; adolescent; epidemiology

La traduction du résumé se trouve à la fin de l'article.

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Self-harm refers to non-fatal self-poisoning or self-injury, irrespective of the apparent purpose.<sup>1</sup> Similar to non-fatal suicide-related behaviours,<sup>2</sup> self-harm encompasses suicide attempts as well as non-suicidal self-injury. Self-harm is a major risk factor for suicide,<sup>3</sup> the second-leading cause of death in 15-24 year-olds worldwide.<sup>4</sup> Self-harm among youth is also a public health issue in its own right: it is associated with health and psychosocial problems,<sup>5</sup> it is common (roughly 1 in 20 high school students reported an episode of self-harm in the previous year)<sup>6</sup> and the frequency peaks in the late teens.<sup>7</sup> In fact, US data showed self-harm was a factor in just over 700,000 emergency department presentations annually<sup>8</sup> and about a quarter of them were by teens.<sup>9</sup> However, there has been relatively little Canadian research on self-harm in youth. This may explain, at least in part, why self-harm has received less attention for public health action as it has in other countries. For example, Canada does not have a national suicide prevention strategy,<sup>10</sup> nationally-endorsed clinical guidelines for self-harm (such as those from the National Institute for Health and Clinical Excellence)<sup>1</sup> or a self-harm monitoring system, all of which have been implemented in England.<sup>11</sup>

This study used population-based health services data to describe emergency department presentations for self-harm among Ontario youth. Demographic and clinical characteristics were interpreted in the context of similar data reported from multi-site studies in other countries.

## METHODS

### Sampling procedures

Emergency department presentations were defined from the National Ambulatory Care Reporting System (NACRS). These data capture every emergency department visit; all legal residents are insured for acute and primary health care services and every hospital submitted NACRS emergency department data during the

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**Conflict of Interest:** None to declare.

**Table 1.** Methods of Self-harm Identified in Emergency Department Presentations by 12-17 Year-olds in the Province of Ontario Between April 1, 2002 and March 31, 2009

Method of Self-harm	Self-harm Definition 1		Self-harm Definition 2	
	n	%	n	%
Self-poisoning only	11,113	66.0%	15,102	66.9%
Self-cutting only	4204	25.0%	5856	25.9%
Other injuries only	1336	7.9%	1325	5.9%
Multiple methods	182	1.1%	306	1.4%

Self-harm definition 1 (SH1): records that list any International Classification of Diseases, version 10 (ICD-10) code for intentional self-harm (ICD-10: X60-84). Self-harm definition 2: as with SH1, as well as records that list any codes for poisoning, undetermined intent (ICD-10: Y10-19) or contact with sharp object, undetermined intent (ICD-10: Y28).

**Table 2.** Self-harm as a Proportion of All Emergency Department Presentations by 12-17 Year-olds in the Province of Ontario Between April 1, 2002 and March 31, 2009

Variable	All Emergency Department Presentations n <sub>0</sub>	Self-harm Definition 1		Self-harm Definition 2	
		n <sub>1</sub>	% (n <sub>1</sub> /n <sub>0</sub> )	n <sub>2</sub>	% (n <sub>2</sub> /n <sub>0</sub> )
Overall	2,439,939	16,835	0.7%	22,589	0.9%
Sex					
Girls	1,182,124	12,892	1.1%	16,282	1.4%
Boys	1,257,754	3943	0.3%	6307	0.5%
Age (years)					
12-15	1,482,905	8182	0.6%	11,052	0.7%
16-17	957,034	8653	0.9%	11,537	1.2%
Canadian Triage and Acuity Scale					
Resuscitation/emergent	137,076	6500	4.7%	8366	6.1%
Urgent	711,301	7553	1.1%	9822	1.4%
Non-/semi-urgent	1,591,562	2782	0.2%	4401	0.3%
Disposition					
Admitted	96,087	5599	5.8%	6537	6.8%
Discharged	2,210,378	10,234	0.5%	14,689	0.7%
Transferred	21,943	705	3.2%	822	3.7%
Left before visit completed	111,531	297	0.3%	541	0.5%

Self-harm definition 1 (SH1): records that list any International Classification of Diseases, version 10 (ICD-10) code for intentional self-harm (ICD-10: X60-84). Self-harm definition 2: as with SH1, as well as records that list any codes for poisoning, undetermined intent (ICD-10: Y10-19) or contact with sharp object, undetermined intent (ICD-10: Y28).

study period. All emergency department presentations by 12-17 year-old Ontario residents over the seven-year period between April 1, 2002 and March 31, 2009 were selected, excluding deaths on arrival or in the emergency department (n=406); scheduled visits (n=14,443); and those where the individual left without being seen (n=169). After these exclusions, there were 2,439,939 emergency department presentations by 910,756 individuals. Self-harm presentations were identified as a subset of these data, selected where any of the diagnoses indicated self-harm. Two definitions of self-harm were used to accommodate potential under-ascertainment:<sup>12</sup>

- Self-harm definition 1: any International Classification of Diseases, version 10 (ICD-10) code for intentional self-harm (ICD-10: X60-84).
- Self-harm definition 2: as above, as well as any codes for poisoning, undetermined intent (ICD-10: Y10-19) or contact with sharp object, undetermined intent (ICD-10: Y28).

## Measures

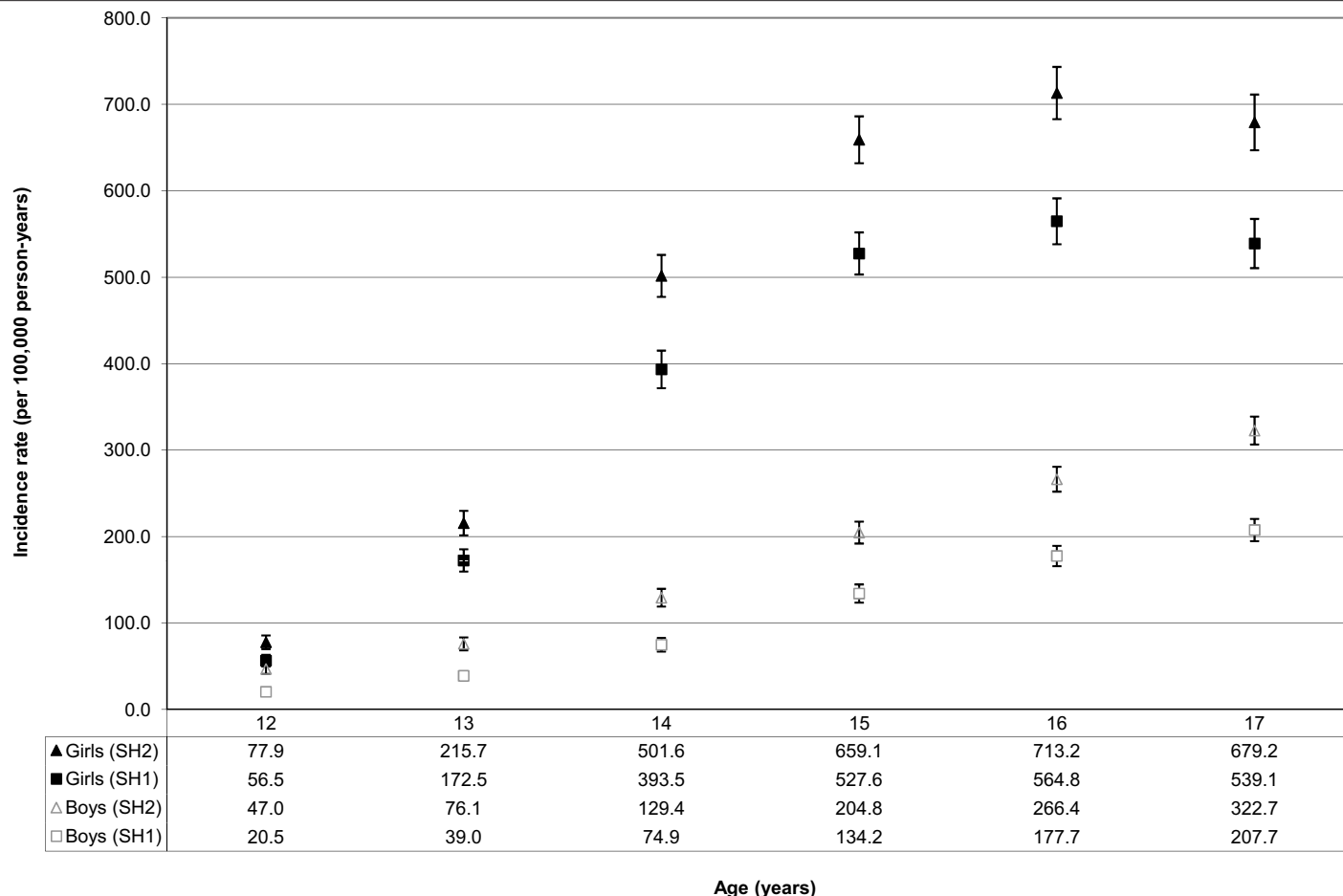
Age and sex were obtained from the NACRS record. Community size and neighbourhood income quintile were obtained using the individual's residential postal code and the Statistics Canada Postal Code Conversion File (PCCF).<sup>13</sup> For both measures, individuals were assigned to their dissemination area: a small, relatively stable geographic unit and the smallest standard geographic area for which census data are produced. Community size (the population, in 2006, of the larger community in which the individual resided) was categorized by the PCCF as: 1,500,000+; 500,000-1,499,999; 100,000-499,999; 10,000-99,999; <10,000 or missing. "Rural" residence was defined according to Statistics Canada's recommended definition of rural and small town, i.e., population <10,000.<sup>14</sup>

Neighbourhood income quintile (a measure of income of the individual's residential area, in 2006, relative to the larger community) was assigned by the PCCF using the mean income per person equivalent (household income, adjusted for household size), calculated for each dissemination area. Using this information, dissemination areas were ranked, within cities, towns or rural/small town areas, and the populations of each were divided into approximate fifths to create community-specific income quintiles. Method of self-harm was defined using external cause of injury codes listed on the NACRS record and categorized as: self-poisoning only (ICD-10: X60-69 [and/or ICD-10: Y10-19 under SH2]); self-cutting only (ICD-10: X78 [and/or ICD-10: Y28 under SH2]); other injuries only (ICD-10: X70-77; X79-84); or, multiple methods. Acuity was measured by a validated triage score, the Canadian Triage and Acuity Scale,<sup>15</sup> obtained from the NACRS record and recorded as resuscitation, emergent, urgent, semi-urgent, or non-urgent. Disposition from the emergency department was categorized as: admitted; transferred to another ED; left before visit completed (left without treatment or against medical advice); or, discharged.

## Statistical analysis

Data were described with frequencies and proportions. Incidence rates were calculated, overall and according to demographic characteristics. The numerators were the number of self-harm presentations, including multiple events by the same person. The denominators were the amount of person-years, calculated by summing the annual population estimates (using 2006 census and intercensal estimates for age- and sex-specific estimates or the Registered Persons Database<sup>16</sup> for community size and neighbour-

**Figure 1.** Incidence rate (and 95% confidence interval) of emergency department presentations for self-harm, by age and sex, for 12-17 year-olds in the Province of Ontario between April 1, 2002 and March 31, 2009



Self-harm definition 1 (SH1): records that list any International Classification of Diseases, version 10 (ICD-10) code for intentional self-harm (ICD-10: X60-84). Self-harm definition 2 (SH2): as with SH1, as well as records that list any codes for poisoning, undetermined intent (ICD-10: Y10-19) or contact with sharp object, undetermined intent (ICD-10: Y28).

hood income quintile specific estimates). Rates were expressed per 100,000 person-years with 95% confidence intervals (CIs) calculated to account for clustering from multiple events per person.<sup>17</sup> All analyses were carried out using SAS version 9.1.<sup>18</sup>

Ethics approval was obtained from the Research Ethics Boards of St. Michael's and Sunnybrook Hospitals.

**RESULTS**

Over the 7-year period, among 12-17 year-olds in Ontario, there were 16,835 self-harm presentations by 12,907 individuals under self-harm definition 1 and 22,589 presentations by 17,557 individuals under self-harm definition 2. As shown in Table 1, the most common method of self-harm was self-poisoning only, then self-cutting only, other injuries only, or multiple methods. Nearly all self-poisonings involved medicinal agents, 10,383 (93.4%) under self-harm definition 1 and 13,754 (91.1%) under self-harm definition 2.

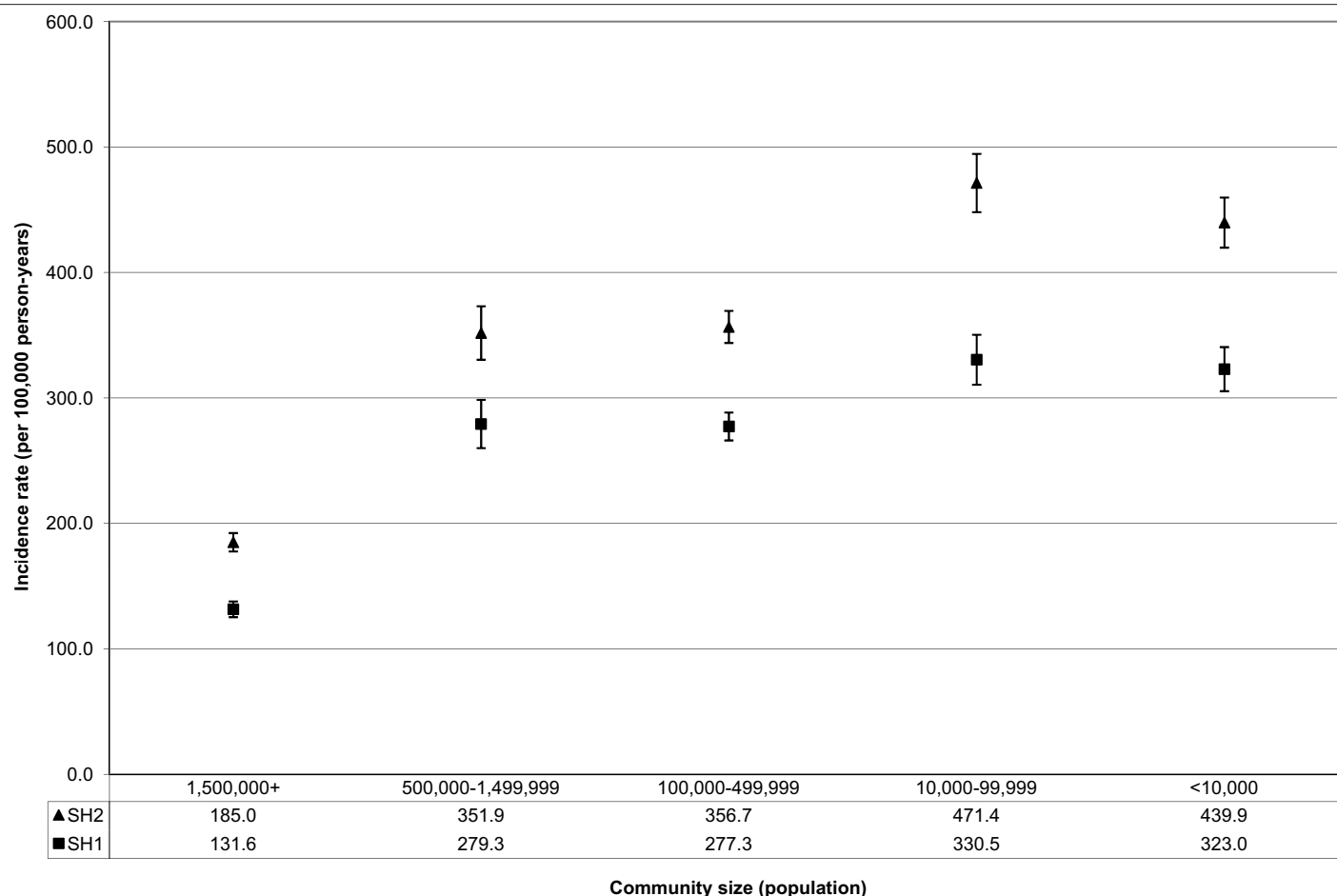
The overall incidence rate of emergency department presentations for self-harm by 12-17 year-olds was 239.0 (95% CI: 233.1-244.9) per 100,000 person-years under self-harm definition 1 and 320.7 (95% CI: 314.0-327.4) per 100,000 person-years under self-harm definition 2. The sex-specific incidence rate estimates under self-harm definition 1 were 375.7 (95% CI: 364.4-387.0) per 100,000 person-years for girls and 109.2 (95% CI: 105.1-113.2) per

100,000 person-years for boys. The corresponding rates under self-harm definition 2 were 474.5 (95% CI: 461.8-487.3) per 100,000 person-years for girls and 174.6 (95% CI: 169.5-179.7) per 100,000 person-years for boys. Figure 1 shows the incidence rates increased with age in both boys and girls, but were always higher in girls. Figure 2 shows the incidence rates were highest in low-population areas (and vice versa). Figure 3 shows an inverse relationship between neighbourhood income quintile and self-harm presentations; that is, 12-17 year-olds living in the lowest-income neighbourhoods had the highest rates (and vice versa).

Table 2 shows that self-harm made up roughly 1 in 100 emergency department presentations among Ontario youth, but also made up a larger proportion of complex presentations; self-harm accounted for at least 1 in 20 presentations triaged as highest acuity (resuscitation/emergent) or admitted to hospital. The higher frequency of self-harm among girls and with increasing age was also reflected here; the proportion of total emergency department presentations related to self-harm was higher in girls than in boys and increased with age.

**DISCUSSION**

These data show self-harm presentations among Ontario youth are consistent with those reported from other countries. In particular,

**Figure 2.** Incidence rate (and 95% confidence interval) of emergency department presentations for self-harm, by community size, for 12-17 year-olds in the Province of Ontario between April 1, 2002 and March 31, 2009

Self-harm definition 1 (SH1): record that lists any International Classification of Diseases, version 10 (ICD-10) code for intentional self-harm (ICD-10: X60-84).  
 Self-harm definition 2 (SH2): as with SH1, as well as records that list any codes for poisoning, undetermined intent (ICD-10: Y10-19) or contact with sharp object, undetermined intent (ICD-10: Y28).

incidence rates are strikingly similar to those in the United States<sup>19</sup> and Ireland.<sup>20</sup> While rates reported from England are considerably higher,<sup>11</sup> each of these international data have consistently found girls outnumber boys; frequency increases with age; and method of self-harm is most often self-poisoning, then self-cutting (in fact, similar to the results from England, a previous study showed Ontario youth most often self-poisoned with analgesics, typically acetaminophen, then antidepressants<sup>21</sup>). The association with neighbourhood income has also been reported among youth in England,<sup>22</sup> and is thought to involve mechanisms including family (genetic and environmental factors), exposure to violence, lifestyle (e.g., substance abuse) and housing. Conversely, these Ontario data showed that about one third of youth who presented to the emergency department for self-harm were admitted, whereas admission occurred in about half in the United States to nearly three quarters in England. This difference may reflect differences in acuity and/or health service availability, or possibly the guidance provided to clinicians in American<sup>23</sup> and British<sup>1</sup> guidelines around the decision to admit.

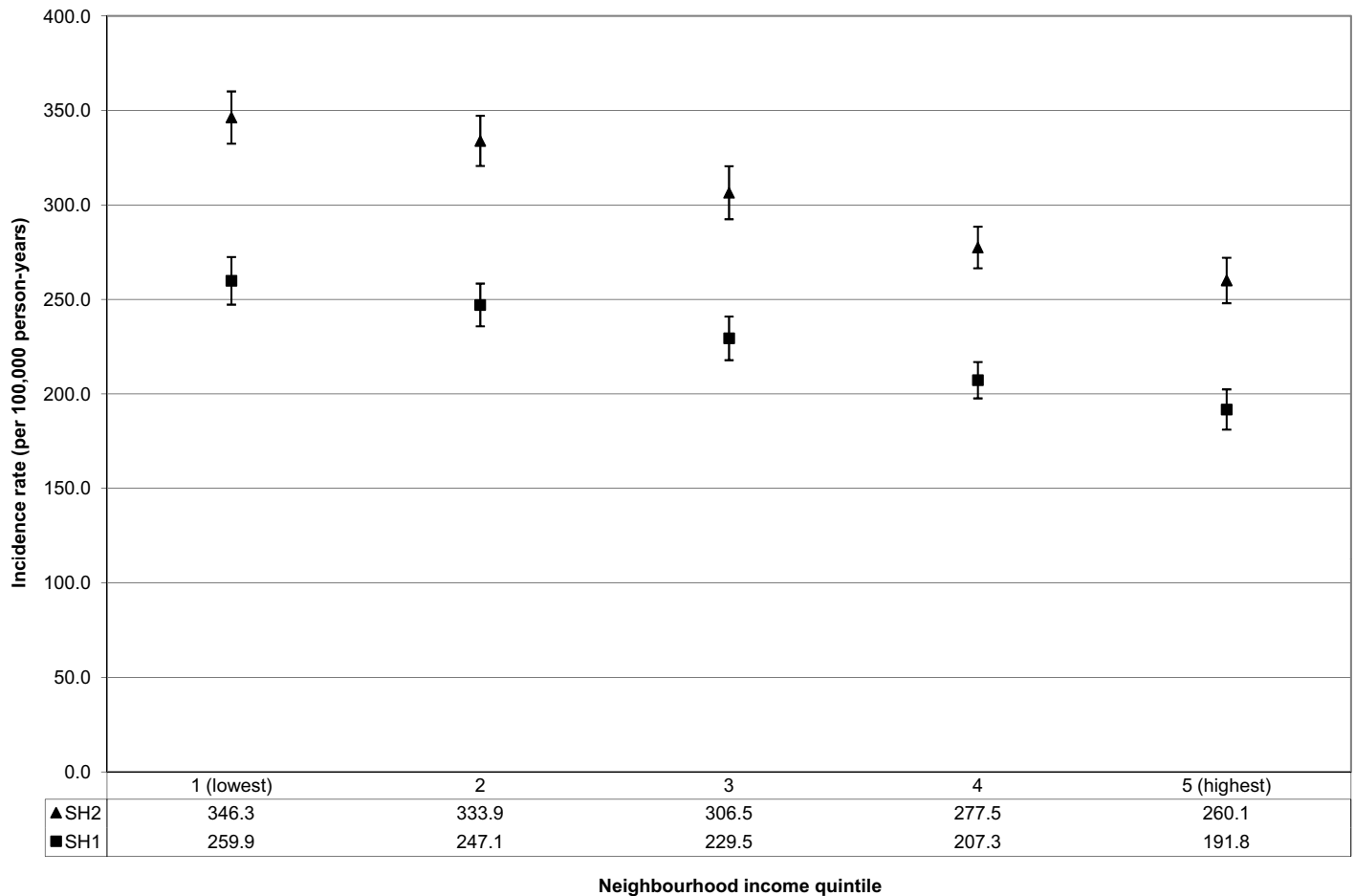
New findings were also presented here with respect to incidence rates by community size; the rate was lowest among youth living in Toronto (Ontario's only city with a population >1,500,000) and highest among those living in rural and low-population areas.

Although people living in Ontario's rural areas tend to use the emergency department more often than those in the rest of the province,<sup>24</sup> given that the pattern of self-harm presentation rates mirrors those of Canadian suicide rates,<sup>25</sup> it seems unlikely to be the only explanation. More plausible hypotheses may overlap with the mechanisms proposed to explain these higher suicide rates in rural areas.<sup>26</sup> For example, socio-economic disadvantage, differences in service delivery systems (e.g., high-population areas' better access to potentially-preventive mental health services) and the populations' ethnic composition may be important factors. With respect to the latter, it may be that patterns seen in suicide rates, such as the "healthy immigrant effect"<sup>27</sup> or the high suicide rate among Aboriginal populations,<sup>28</sup> extend to self-harm (although it is also important to note that these findings do not apply evenly across these diverse populations<sup>29,30</sup>).

### Limitations

Although administrative data are a vital source of information for health policy and planning and offer numerous advantages for studying self-harm, key limitations must be acknowledged. First, of those who present to the emergency department, the self-inflicted nature of their injury or poisoning may go undetected or unrecorded. For example, the individual may be hesitant to disclose and/or

**Figure 3.** Incidence rate (and 95% confidence interval) of emergency department presentations for self-harm, by neighbourhood income quintile, for 12-17 year-olds in the Province of Ontario between April 1, 2002 and March 31, 2009



Self-harm definition 1 (SH1): records that list any International Classification of Diseases, version 10 (ICD-10) code for intentional self-harm (ICD-10: X60-84). Self-harm definition 2 (SH2): as with SH1, as well as records that list any codes for poisoning, undetermined intent (ICD-10: Y10-19) or contact with sharp object, undetermined intent (ICD-10: Y28).

the clinician may be reluctant to document self-harm. While an attempt was made to account for some of the probable underascertainment of self-harm by including presentations coded as undetermined,<sup>12</sup> it is still unclear which definition of self-harm is most accurate. Second, it was impossible to disaggregate self-harm by suicidal intent; such information is not included in the current NACRS data and ICD does not distinguish suicidal and non-suicidal acts. Researchers are increasingly acknowledging that, although highly associated, attempted suicide and non-suicidal self-injury do differ and future research should endeavour to distinguish them as such.<sup>31</sup> A system which also incorporates a third category – that where the suicidal intent is undetermined<sup>2</sup> – may also be most useful given difficulties in assessing suicidal intent.<sup>32</sup> Third, this study analyzed self-harm presentations to the emergency department, so results cannot be generalized to those who do not seek this care. Survey data suggest that those who present to hospital likely represent a more suicidal subset of youth who self-harm; the intent to die was the strongest predictor of health service use following self-harm (in both boys and girls).<sup>6</sup>

**Generalizability**

Emergency department data provide more representative information than inpatient admissions;<sup>12</sup> less than half of those who pres-

ent to the emergency department for self-harm are admitted and admission is associated with various factors, including method of self-harm.<sup>21</sup> The epidemiology and characteristics of emergency department presentations for self-harm among Ontario youth are quite consistent with those reported from other countries, suggesting generalizability of study results between populations. However, it is unclear whether these findings extend across Canada. Canada does not currently maintain a national emergency department data system; the 2011 Health Indicators report from the Canadian Institute for Health Information and Statistics Canada, the first ever on self-harm, reported mainly on inpatient admissions. The emergency department data that were included, from Ontario, Alberta and the Yukon, suggested differences between these provinces and territory in the frequency of self-harm presentations (including specifically among teenage girls).<sup>33</sup>

**CONCLUSIONS AND FUTURE DIRECTIONS**

Self-harm is an important public health issue in Canada, requiring a comprehensive prevention approach. For example, addressing the strong association between self-harm and suicide (and the even-higher risk among those who repeatedly present to the emergency department for self-harm),<sup>34</sup> the World Health Organization’s framework for public health action in suicide prevention specifi-



cally recognizes the importance of assessing and managing those who present to a health care facility for self-harm.<sup>35</sup> In this regard, roles for primary care, including involvement in the transition from the emergency department to aftercare,<sup>36</sup> also seem critical.

Ontario has useful existing data and infrastructure to study emergency department presentations for self-harm: there is near-complete coverage of the population; all hospitals submit emergency department data; and health services, including inpatient admissions, emergency department presentations, and physician visits, can be individually linked over time. Emergency department presentations for self-harm have been interpreted as a measure of access to mental health services,<sup>33</sup> so these data can offer valuable opportunities to evaluate strategies to improve mental health outcomes in youth.

Future research should address the reasons for the geographic differences in self-harm, and in particular, explanations for the finding that emergency department presentations for self-harm are more common among youth living in rural and low-population areas. Given that the highest youth suicide rates in Canada are among those living in rural areas, assessing the factors that contribute to this pattern could have broader implications for prevention.

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## RÉSUMÉ

**OBJECTIFS :** L'automutilation est un important problème de santé publique chez les jeunes, ainsi qu'un grand facteur de risque de suicide (une des principales causes de mortalité dans ce groupe d'âge). À l'aide des données populationnelles des services d'urgence, nous décrivons le profil clinique et démographique de jeunes (12-17 ans) s'étant présentés aux urgences dans la province de l'Ontario, au Canada, après s'être automutilés.

**MÉTHODE :** Nous avons utilisé des données administratives saisissant toutes les visites aux urgences en Ontario survenues entre le 1<sup>er</sup> avril 2002 et le 31 mars 2009 pour repérer et décrire les cas d'automutilation.

**RÉSULTATS :** Sur les sept années de l'étude (2002-2003 à 2008-2009), il y a eu 16 835 cas d'automutilation chez 12 907 jeunes. Les deux tiers des cas d'automutilation étaient des auto-empoisonnements (presque toujours avec des agents médicinaux), suivis par des coupures auto-infligées (environ le quart des incidents). Les taux d'incidence étaient plus élevés chez les filles que chez les garçons, augmentaient avec l'âge, étaient inversement liés au revenu selon le quartier et atteignaient les plus hauts niveaux en milieu rural. L'automutilation représentait environ 1 cas sur 100 chez les jeunes s'étant présentés aux urgences, mais aussi un nombre démesuré de cas orientés vers les soins aigus ou hospitalisés (environ 1 sur 20).

## SELF-HARM AMONG ONTARIO YOUTH

**CONCLUSION :** L'automutilation est un important problème de santé publique qui exige une démarche de prévention globale. L'Ontario détient des données utiles pour étudier les cas d'automutilation gérés par les services d'urgence; les ressemblances entre les cas d'automutilation chez les jeunes de l'Ontario et ceux déclarés aux États-Unis et en Europe montrent que les résultats obtenus dans différentes populations pourraient être généralisables. Il faudrait pousser la recherche pour découvrir les raisons des écarts géographiques dans la fréquence de l'automutilation.

**MOTS CLÉS :** comportement automutilatoire; secours médicaux d'urgence; enfant; adolescent; épidémiologie